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THE FOUNDRY TRADE JOURNAL IS THE OFFICIAL ORGAN OF THE INSTITUTE OF BRITISH FOUNDRYMEN; THE WELSH ENGINEERS' AND FOUNDERS' ASSOCIATION, AND THE FOUNDRY TRADES' EQUIPMENT AND SUPPLIES ASSOCIATION.

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Foundry Technical Institute, Meek's Road, Falkirk *Telephone 322).*

Forthcoming Events.

JANUARY 26.

Sheffield Metallurgical Association:—"Tests of Aircraft Materials and Components," Paper by I. G. Gerrard, M.Sc.

Institute of British Foundrymen.

JANUARY 29.

London Branch (Junior Section):—Ordinary meeting in London. Paper by H. W. Keeble.

JANUARY 30.

Lancashire Branch (Junior Section):—Visit to the works of Messrs. George Richards & Company, Limited, Broadheath.

East Midlands Branch:—Ordinary meeting at Loughborough. "Production of Ferrous and Non-Ferrous Castings for High-Class Internal-Combustion Engines," Paper by S. White.

Newcastle-on-Tyne and District Branch:—Ordinary meeting. "Black Sand," Paper by B. Hird.

Wages and Prices.

A most interesting inquiry has just been completed by the International Labour Office at Geneva on behalf of the Ford Motor Company. In order to ascertain precisely what wages should be paid to Ford employees in possible European factories to give them the same purchasing power as is enjoyed by the Ford employees at Detroit, experts went into the cost of living in each of fourteen European cities—Berlin, Frankfort, Copenhagen, Stockholm, Helsingfors, Paris, Marseilles, Antwerp, Rotterdam, Manchester, Cork, Warsaw, Barcelona, Constantinople. It is generally accepted that the level of wages is not so important as what those wages will buy; in other words, wages and prices are interdependent. The price of any article, in fact, is ultimately made up of wages paid in getting the material, transforming it into a market requirement and distributing it to that market. A worker may be worse off in a high-wages country, suffering from high prices, than in a low-wage country where living is cheaper. Many people think that workers in this country are, on the whole, better off than those in America where wages are higher.

The comparisons are made for January, 1931, and housing, fuel and light, clothing, medical and miscellaneous expenses were all included, as well as food. The Detroit figure is given as 100, and the following figures show, for example, what workers in each of the cities mentioned would require to be paid in order to be as well off as a worker in Detroit would be if his wages were represented by 100. Berlin, 83-90; Frankfort, 85-93; Copenhagen, 83-91; Stockholm, 99-104; Helsingfors, 83; Paris, 80-87, Marseilles, 75-81; Antwerp, 61-65; Rotterdam, 65-68; Manchester, 71-74; Cork, 85; Warsaw, 67; Barcelona, 58; Constantinople, 65.

The figures throw a flood of light on the cost of living in various great European cities, and they show to what a great extent cost of living and wages are equated. Stockholm is the only city where the cost of living is greater than Detroit, where it was found that the average expenditure per annum of the type of working family dealt with was 1,720 dollars. The figures reveal what should be paid to maintain the Detroit standard, which is admittedly high even for America. It does not follow, of course, that these wages are, in fact, actually paid in the cities concerned. They may be more and they may be less in different industries. An inquiry as to what is paid would reveal whether the workers of any one country are any better off than those of another, *i.e.*, whether they enjoy a greater purchasing power. If they do, it is probably due to the fact that they work harder and give greater outputs for the wage earned. If the price of an article is mainly the cost of labour in its manufacture, this could scarcely fail to be the case.

Improvisations.

We remember that in connection with the 1929 German Foundry Exhibition there was produced a series of pictures indicating the seven cardinal sins of the foundry. We do not remember whether improvisation was included as a cardinal sin, but it always impresses us as being the most serious defect in foundry activities.

On entering the average foundry office, the structure itself, its furniture and files, its heating and lighting are just an aggregation of temporary improvisations, awaiting better trading conditions for improvement or rehousing. Then the roadways and gangways are only too often improvised, whilst those of the fitting and erecting shops are finished jobs. Cupolas have to be entered every day or so to be repaired, yet the tackle used—such as rickety ladders, rope contraptions, inadequate lighting arrangements, disreputable-looking tin cans serving instead of buckets, good packing cases used as scrap wood for lighting-up purposes—all speak of these improvised methods of manufacture.

We do not criticise certain of the improvisations used in jobbing foundry moulding practice, as these, when cleverly applied, often make the difference between profit and loss, but when special tackle has to be made some thought should be given to make it adaptable for as many jobs as possible. Moulding boxes lend themselves specially to such foresight.

The next section which suffers from this evil is the fettling department, wherein one encounters rickety benches, tools used long after they have lost their efficiency, furnace roofs used as stores, nails on which coats are hourly exposed to dust and grime. Some of the improvisations one encounters in the foundry are unreasonable—flapping trousers are a poor substitute for proper spats, old rags for gauntlets; whilst barrows and shovels as units of measurement are totally inadequate. Many of the ladles still being used warrant no other description than improvisations, pending the arrival of the modern article. Finally, it would be well if foundry executives would regard some of their melting furnaces and drying ovens as something of a temporary nature, pending delivery of modern plant which has long superseded their installations. These last, of course, are relatively important capital expenditures, but we do counsel our readers, in the interests of the whole industry, not to countenance a mass of improvised methods and machines in their foundries. The great adaptability of the old-fashioned foundrymen and his masterly efficiency as a craftsman have combined to do more detriment to the equipment and modernisation of the foundry industry than any other factor.

XUM

I.B.F. Elects New Members.

At a Council meeting of the Institute of British Foundrymen, held last Saturday at St. Pancras Hotel, London, over 100 members were elected to its various grades.

Subscribing Firms.

John Dewhurst, Limited, Moorbrook Foundry, Aqueduct Street, Preston.

Thomas Dryden & Sons, Grimshaw Street Foundry, Preston.

W. Woodcock, Sons & Company, Limited, Phœnix Foundry, Ravenhead, St. Helens.

Dilworth & Carr, Limited, Bow Lane Foundry, Preston.

J. Foster & Sons, Limited, Soho Foundry, Preston.

Eclipse Tube Mill Liners, Limited, Industrial Sites, Benoni, South Africa.

Members.

C. C. Day, engineer, Mirrlees, Bickerton & Day, Hazel Grove, Stockport.

W. Dewhurst, director, John Dewhurst, Limited, Moorbrook Foundry, Preston.

George M. Menzies, Jnr., North British Steel Foundry, Limited.

V. K. Rice, master patternmaker, V. K. Rice, Durban, S.A.

J. Simpson, foundry manager, Brown Bros. & Company, Limited, Edinburgh.

P. L. Ward, B.Sc., metallurgist, Eclipse Tube Mill Company, Benoni, S.A.

J. F. Martin, sales manager, Foster Instrument Company, Letchworth.

C. H. Robins, works manager, C. Wicksteed & Company, Kettering.

W. G. Smith, foundry representative, Sternol, Limited, London.

E. W. Wynn, Henry Ford & Son, Limited, Dagenham.

H. H. Beeny, works metallurgist, A. Herbert, Limited, Coventry.

A. E. Lester, foundry manager, Baker's Foundry Company, Smethwick.

J. Martin, managing director, Fyfe, Donaldson & Company, Limited, Johnstone, Scotland.

I. S. Osborn, director, Samuel Osborn & Company, Limited, Sheffield.

R. Potter, Robert Potter & Son, Glasgow.

Associate Members.

R. Atkinson, foreman patternmaker, Leyland Motors, Limited, Leyland.

S. Billcliffe, steel foundry superintendent, Leyland Motors, Limited, Leyland.

J. Blackhurst, foreman patternmaker, Leyland Motors, Limited, Leyland.

E. Brade, moulder, Leyland Motors, Limited, Leyland.

W. Wharton, metallurgist, Leyland Motors, Limited, Leyland.

E. Wilson, steel dresser, Leyland Motors, Limited, Leyland.

J. Wilson, moulder, Leyland Motors, Limited, Leyland.

E. L. Winter, foundry foreman, British Northrop Loom Company, Moss Street, Blackburn.

T. Woods, moulder, Leyland Motors, Limited, Leyland.

W. Woods, coremaker, Leyland Motors, Limited, Leyland.

J. Yates, foreman moulder, J. Dewhurst, Limited, Moorbrook Foundry, Preston.

L. Buckley, foundry superintendent, Leyland Motors, Limited, Leyland.

T. B. Burrows, moulder, Hattersley's (Ormskirk), Limited.

W. E. Campbell, moulder, Leyland Motors, Limited, Leyland.

J. Cartmell, assistant foreman patternmaker, Leyland Motors, Limited, Leyland.

T. Clark, maintenance foreman, Leyland Motors, Limited, Leyland.

W. Dowbing, moulder, Leyland Motors, Limited, Leyland.

R. B. Duckworth, patternmaker, Duckworth Bros., Skeffington Road, Preston.

W. Duckworth, patternmaker, Duckworth Bros., Skeffington Road, Preston.

A. Earnshaw, foreman brass moulder, Hattersley's (Ormskirk), Limited.

W. Farnworth, moulder, Leyland Motors, Limited, Leyland.

J. Farrell, moulder, Leyland Motors, Limited, Leyland.

A. J. Forsythe, moulder, Leyland Motors, Limited, Leyland.

H. H. Foster, moulder, Hattersley's (Ormskirk, Limited).

R. Gardner, foundry foreman, Dilworth & Carr, Limited, Preston.

R. Greer, moulder, Leyland Motors, Limited, Leyland.

W. Gregg, foreman patternmaker, Thomas Dryden & Sons, Grimshaw Street, Preston.

F. Harrison, assistant metallurgical chemist, Leyland Motors, Limited, Leyland.

G. Hewitson, moulder, Thomas Dryden & Sons, Grimshaw Street, Preston.

J. Higginson, foundry foreman, Leyland Motors, Limited, Leyland.

W. E. Hindle, moulder, John Whitehead & Company, Albert Ironworks, Preston.

C. C. Hodgson, metallurgist, Leyland Motors, Limited, Leyland.

J. Holcroft, moulder, R. Baxendale & Son, Albert Street, Chorley.

H. Holt, assistant metallurgist, Leyland Motors, Limited, Leyland.

H. W. Humble, metallurgist, Leyland Motors, Limited, Leyland.

S. T. D. Kelley, assistant chemist, Leyland Motors, Limited, Leyland.

P. Leyland, progress clerk, Leyland Motors, Limited, Leyland.

J. J. Mills, engineer, Leyland Motors, Limited, Leyland.

H. Mayoh, metallurgist, Leyland Motors, Limited, Leyland.

E. V. Mechelen, foreman coremaker, Leyland Motors, Limited, Leyland.

H. Morris, moulder, Whitehead & Poole, Limited, Radcliffe.

C. G. McLean, foreman moulder, J. Foster & Sons, Soho Foundry, Preston.

J. McVeigh, foreman moulder, Leyland Motors, Limited, Leyland.

J. B. McWilliam, moulder, J. Dewhurst, Limited, Moorbrook Foundry, Preston.

W. Nightingale, moulder, Leyland Motors, Limited, Leyland.

R. Orrell, moulder, Leyland Motors, Limited, Leyland.

J. T. Parsons, foreman moulder, Leyland Motors, Limited, Leyland.

R. H. Potter, apprentice, Hattersley's (Ormskirk, Limited).

H. Reid, foreman dresser, Leyland Motors, Limited, Leyland.

J. A. Robertson, publicity clerk, Hattersley's (Ormskirk, Limited).

A. Roskeer, assistant metallurgist, Leyland Motors, Limited, Leyland.

J. Sharples, Jun., patternmaker, Caves & Sharples, 77, Fleming Square, Blackburn.

H. Sinclair, foreman moulder, Thomas Dryden & Sons, Grimshaw Street, Preston.

R. P. Smithies, foreman turner, Leyland Motors, Limited, Leyland.

L. Staziker, foreman coremaker, Leyland Motors, Limited, Leyland.

H. Theobald, moulder, Leyland Motors, Limited, Leyland.

J. A. Turner, moulder, Leyland Motors, Limited, Leyland.

A. Waller, moulder, J. Dewhurst & Sons, Moorbrook Foundry, Preston.

W. Webster, moulder, John Dewhurst, Limited, Moorbrook Foundry, Preston.

(*Concluded on page 54.*)

Random Shots.

I'm glad to see that our inventors never reduced their thought-output during the past year. They worked away on gadgets and devices which in their opinion, if not in other people's, will make life better and easier for all of us. That is good of them. Some thirty-six hundred patent applications were filed in 1931, and of these a seventh roughly related to electricity. A large proportion this, but, of course, though past its childhood the electrical industry has yet to attain its full stature. There are heaps more different types of bells that can be invented, and little things like electrical lawnmowers and even electrical surprises, are waiting to be devised.

* * *

The usual crop of patents connected with metallurgy appeared, especially those for alloys. (I often think that there's less in these patented alloys than meets the eye in the specification.) Particularly in evidence, too, were improvements and new devices for the centrifugal casting of metals. For spinning blanks are some of these; they make Marksman's head spin invariably. (Q.—Is Marksman's head a blank?)

* * *

What I've yet to see in a specification, however, is an invention which relates to improved methods for the invention of inventions, etc. It will come I doubt not.

* * *

Without Comment.—"Members of a non-swearing club in Kent paid fines during 1931 totalling £26."

* * *

Here is a jingle come to me after many removes from its original source. It is good.

Absolute knowledge I have none,
But my aunt's washerwoman's son
Heard a policeman on his beat
Say to a labourer in the street,
That he had a letter just last week
Written in the finest Greek,
By a Chinese coolie in Timbuctoo,
Who said that the negroes in Cuba knew
Of a coloured man in a Texas town,
Who got it straight from a circus clown
That a man in the Klondyke heard the news
From a gang of South American Jews
About somebody in Bamboo,
Who saw a man who claimed he knew,
From a son of his who had a friend (who could tell)
When the depression is going to end.

* * *

A bright idea was suggested to me by a lady friend who, seeing a photomicrograph of grey iron, thought what a pretty pattern it would make for cretonnes and dress materials. Marksman is now collecting unwanted micrographs and offering the "patterns" at modest figures to the textile people. If you do have any micrographs, and it is not too much trouble . . Thank you!

* * *

Linguists will appreciate the following story, perhaps.

A schoolmistress was taking a French lesson. She indicated various parts of the body, and starting a simple sentence would call upon a pupil to complete it.

"Ces cheveux ——," she began, and a pupil said, "Sont noirs."

"Very good. Ces oreilles ——." "Sont petites."

"Ces yeux——." "Sez me!"

MARKSMAN.

The Situation of German Iron Foundries in 1931.

By Dr.-Ing. Th. Geilenkirchen (Editor of "Die Giesserei," and Director of the German Iron Foundry Employers' Federation).

If, on entering upon the year 1931, the hope was expressed everywhere that, after several years of depression, the lowest point had been reached and a revival might begin, the actual development in 1931 most bitterly disillusioned all hopes. The decline in the state of trade and industry and of the whole world economic situation reached a level which had never previously been experienced, and which would not have been considered possible. It would be idle here to enter specially on the causes of the world economic crisis; they are recognised to-day by students of economics.

The adherence to the impracticable burden of reparations, together with the violent interference in the international exchange of commodities, which should rest on the most careful weighing of the performances in return for counter performances, has led to a world economic crisis from which the victorious countries also have not been spared, but which the weakened German national exchequer was least of all able to bear, as in consequence of the continued withdrawal of capital during a decade, it had more and more to abandon the fulfilment of its own requirements. In addition to small concerns having little capital, large undertakings in all branches of activity were also not impregnable against financial pressure, and the considerable elimination of important undertakings, which started after the decline in general business activity in 1927, involved many important concerns.

Naturally, these developments had their full effect on German iron foundries. As suppliers of the finishing industry and the merchants, they are dependent upon the welfare of their customers, and consequently automatically lose sales when business is bad in these branches. The retrogression in the degree of activity consequently brought it about that at the end of 1931 the iron foundries only employed about one-third of the normal number of moulders, and these only incompletely, so that the average index of activity of the German iron foundries may be assumed to be less than 25 per cent.

Machinery Castings.

The sales from the German engineering foundries declined with the degree of employment of the German engineering industry, whose inland sales diminished to a minimum, corresponding to the efficiency and purchasing capacity of the industrialists and particularly of the agriculturists. A certain, but by no means sufficient, compensation was obtained in recent years through an increase in the sale of machinery abroad; Russian orders for the carrying out of the Five Years' Plan played a special part in the past year. But a limit has been set to continued development by the circumstance that the Russians demand a credit of several years, which it is impossible for the financially weak German financiers to accord, especially as the ridiculously difficult requirements placed by the Russians as to the quality of the castings bought by them immeasurably increase the risk of the suppliers.

Apart from the increasing growth on all sides of the policy of protective duties, the exports of the German engineering industry are further considerably hampered by the large depreciation of the currencies of many countries, especially England, as compared with the German mark, through the abandonment of the gold standard, so that not only are German exports to the countries concerned rendered extremely difficult, but also German goods are no longer successful in competition with goods coming from these countries. As a consequence, German industry, which in recent years has at least obtained a certain amount of employment from exports, will have to envisage a decrease in a similar manner to the inland sales.

Builders' Castings.

In recent years, under the pressure of the economic conditions, sales to builders' merchants in the branch of castings have also considerably decreased. In the case of builders' castings the question concerns general articles of everyday requirement, in the purchase of which the decisive factor relates less to technical efficiency and economy in use, but solely by suitability in general. For the sale of iron stoves a further unfavourable matter has to be taken into consideration in the sense that the previous winter was comparatively mild and the winter of 1931-32 has also brought about no severe frost, whereas the former extraordinarily severe winters compelled many customers to buy more stoves than usual. The possession of these stoves by consumers curtailed the demand which already was suffering from the diminished purchasing power of the population.

DR.-ING. TH. GEILENKIRCHEN.

Over-Capacity and Under-Production.

In the case of rainwater goods and the like matters were much worse as building activity is depressed and cannot be raised to a normal level within a reasonable time. Unfortunately, in recent years, owing to a lack of appreciation of the future sale possibilities, the shops producing gutters, radiators and boilers, bath tubs and sanitary castings have been largely increased, and the productive capacity has been so augmented by intensive rationalisation that the firms producing builders' castings are easily able to meet the actual requirements of Germany several times over. They are thus more than ever dependent upon exports, which, however, owing to the economic crisis in the world market, the high Customs tariffs of foreign countries, the high German rate of exchange and partly also because of the too high costs of production of the works, are rendered difficult. Moreover, a further difficulty in the sale of builders' castings is the fact that local authorities, because of their indebtedness and the impossibility of getting increased taxes from industry, are now compelled to effect economies all along the line. They are therefore even seeking avenues of economisation by postponing material commitments for drainage schemes and sewerage works, so that essential needs cannot at present be carried out.

Factors in Price Reduction.

The disproportion between supply and demand has naturally led to a great pressure on prices all along the line. For more than a decade the German Iron Foundry Employers' Federation has educated its members in the direction of carrying out a most careful calculation of the costs of production, for which clear and unequivocal principles were given in the so-called Harzburg memorandum of 1919. According to this the sale prices are to be calculated from the total of the manufacturing costs and the business and sales expenses. The first are composed of the cost of the liquid iron, the actual wages paid for production, and the management expenses, which are calculated by a percentage addition to the production wages that is ascertained from the actual conditions. The business and sale expenses, among which are comprised taxes and various public charges, are also placed in proportion to the total manufacturing costs. To the costs of production resulting from the total of the manufacturing costs and the business expenses must, then, be added a suitable margin for profit and risk, so as to be able to compute the sale price. But in view of the general pressure on prices the foundries have at least endeavoured to bring their calculations into harmony with the obtainable sale prices through considerations of a possible reduction in individual factors of the costs of production. Obviously, the first thing they did was partly or entirely to drop the profit-and-risk addition at the end of the calculation and thus consciously renounce a profit in order to be able to maintain the staff and not to discharge moulders who perhaps for decades had been connected with the works in prosperity or misfortune. But on the assumption that the fixed charges could not be reduced, even if the works were at a standstill, orders were frequently accepted in which reduced or finally no additions were calculated for the business expenses, but in which were solely entered the pure costs of the raw and other materials used and the wages.

Price Movements.

Under the influence of this development the relation between costs of production and sale prices for castings has steadily declined since 1927. As was shown in an interesting article in the "Deutsche Bergwerks Zeitung," the costs of producing castings constantly increased between 1927 and 1930, and they first declined in 1931 under the pressure of economic developments. The sale prices followed the increase in the costs of production until 1929, but not commensurately, so that in 1929 the costs of production and sale prices were about on the same level. In 1930, however, the sale prices fell below the further increased costs of production, and in 1931, with declining costs of production, they sank in a greater measure than the latter, so that they are now still lower than the costs of production. Expressed in figures, the year 1927 yielded an average profit to the foundries of 8 per cent., which declined to 3½ per cent. in 1928. In 1929, as stated, the costs of production and sale prices were about on the same level; in 1930 the sale price fell by more than 8 per cent. below the costs of production, and in 1931 the loss rose to about 9¼ per cent.

The depicted pressure on prices was yet artificially increased by the circumstance that for a long time past both the Government and public opinion that is unsympathetic towards industry became imbued with the notion that German national finance could only be saved by

a so-called reduction in prices, even if at the same time wages, which form the determining factor in the costs of production, were maintained on the same level. As a result, considerable price reductions in the commodity market were repeatedly demanded by the Government, before the question of a lowering of wages could be approached. In the case of the foundries, this had the effect of a general pressure on prices, at a time when no kind of reductions in the costs of production permitted of prices being reduced. With the further development came concessions in the prices of raw materials and reductions in wages, and customers therefore again demanded corresponding reductions in the prices of castings without regard to the circumstance that the facilities which had arrived in the costs of production had already been anticipated by the previously-granted reductions in prices.

Compulsory Price Reduction.

The general tendency of declining prices was crowned by the emergency ordinance of December 8, which decreed a reduction of all syndicated prices of at least 10 per cent. as compared with the level of June 30, while at the same time ordering wages all along the line to be lowered by up to 10 per cent, in so far as this would not bring them below the position in January, 1927. As a consequence of this emergency ordinance, the prices of coke and pig-iron had to be reduced by 10 per cent., which naturally, together with the simultaneous reduction of wages, had the effect of causing a considerable lowering in the costs of producing castings. On the other hand, the price of cast-iron scrap, which enters the open market and which in the course of the past year fell to a level never previously known—in part, even below pre-war prices—was not reduced; on the contrary, a hardening tendency was manifested here and there in the prices of cast-iron scrap.

Railway freights, taxes and various public charges have either not been decreased or only inconsiderably reduced. In the case of taxes under the same emergency ordinance, the tax on the turnover, which affects the whole financial structure, was increased from 0.85 per cent. to 2 per cent. The cost for the relief of the unemployed, the number of whom is reaching six millions, also burdens the whole of German industry and the foundries to an extraordinarily high degree. It follows from the comparison that the total costs of production of the foundries have been reduced by much less than 10 per cent.; according to the output of the foundries, it is probable that the real reduction in the cost price lies between 5 and 8 per cent. Nevertheless, the foundries, as was to be expected from the attitude of their customers, are asked in general the full price reduction of 10 per cent. as expressed in the emergency ordinance, and each individual foundry is to-day compelled, in coming to an understanding with its customers, to defend itself against unjustifiable high rebates. The matter is definitely a fight for existence or disappearance, since the large majority of the foundries have, as results from the above statements, already inadequate sale prices, and in no case can bear a further reduction of the conditions between the costs of production and the sale prices. The German Iron Foundry Owners' Federation, in accordance with the price policy which it has carried on in recent years, endeavoured last year to set up a guiding or minimum price-list for castings, which corresponded to the interests of its members; and in this fight it has put before its members the maintenance of a suitable price level, and hopes that its efforts will not be in vain.

A Better Basis for Competition.

After all, it may be hoped that the reduction in the prices of German commodities which was started by the economic crisis and completed by the emergency ordinance, will contribute somewhat towards the revival of the home and export market. The long-awaited lowering of prices undoubtedly caused many consumers to hold back in the satisfying of their normal requirements in goods of all kinds, and, as further reductions in prices are not to be expected within a reasonable period, it is probable that they will now come into the market. It is also probable that the prices of many commodities, through the repeated reductions in the past year, have reached a level which will restore to German producers their competitive capacity in the world market.

Besides such small means for the revival of the market, however, the development of the reparation question within the next few months must decide whether general confidence will return and the world economic crisis be brought closer to its solution. A Germany, which is collapsing under the intolerable burden of reparations, will not only no longer be able to pay its private debts—it will also retire as a customer for products of any kind from the world market, and the already large number of countries which have lost their purchasing power will still be increased by one which formerly was very important for world trade. The way for rendering healthy business leads via the return to reason in the international reparation question.

Catalogues Received.

Rotary Pulverised-Fuel-Fired Furnaces.—Messrs. James Howden & Company, Limited, have sent us a brochure illustrating and describing the Brackelsberg furnace. This furnace is now made in six standard sizes, ranging from 30 cwt. to 15 tons. The booklet is double-jacketed in black, carrying a design tastefully brought out in green and gold. The method used for the presentation of the subject has been to detail the limitations of the cupola, describe the mechanical structure of the Brackelsberg furnace, treat of the coal used, the lining, and the metallurgical and mechanical advantages of the furnaces and the ensuing economies. Fuel costs of various types of furnaces are tabulated, and are followed by notes on the production of grey iron, special alloyed iron, chilled rolls, malleable, steel and refined irons.

As this subject of pulverised-fuel-fired furnaces is at present occupying the minds of many founders, we strongly advise our readers to procure a copy and make themselves familiar with this relatively new and important development.

Steam Traps.—Messrs. Hopkinsons, Limited, of Huddersfield, have sent us a 12-page pamphlet dealing with "Duplus" steam traps. Very effective use has been made of colour printing for illustrating the special features of its construction. As a sensible, businesslike piece of publicity this particular effort approaches the ideal.

Sand Disintegrator. — Messrs. Pneulec, Limited, of Mafeking Road, Smethwick, near Birmingham, have sent us a large-sized post-card illustrating and describing a very simple yet efficient type of portable sand disintegrator.

American Foundrymen's Association Exchange Paper.

Mr. R. S. MacPherran, chief chemist of the Allis-Chalmers Manufacturing Company, Milwaukee, is to present the 1932 Exchange Paper on behalf of the American Foundrymen's Association to the Institute of British Foundrymen's 1932 Annual Conference to be held in Newcastle. Mr. MacPherran has chosen for his subject "High-Test Cast-Iron Developments in the United States."

Publications Received.

Safety Organisation in Factories. Issued by the Home Office and published by H.M. Stationery Office, Adastral House, Kingsway, W.C.2. Price 3d. net.

The object of this leaflet is to outline the essential features of a safety organisation in a factory, its constitution and nature of its functions. So far as one can see, one sets about this particular job exactly as one would in forming a works football and cricket team. The committee should, obviously, be representative, and a section retire in rotation. The "captain" or safety officer should, obviously, be an experienced person. For the rest, it is a plain statement of the work of the committee, and the standards which should be used to make statistics comparable. There are three appendices of quite a useful character, especially a bibliography of publications of interest to safety committees.

Deterioration of Structures in Sea Water. The 12th (interim) Report of the Institution of Civil Engineers. Published by H.M. Stationery Office, Adastral House, Kingsway, London, W.C.2. Price 6d. net.

This Report, in the main, deals with timber and reinforced concrete. Founders will be happy to learn that "at Halifax (Nova Scotia) . . . the hot-blast cast iron appears to be well preserved." This, reading between the lines, places it in the second category. It is apparently not quite as good as "stainless," but better than most competitive materials.

I.B.F. elects New Members.

(*Concluded from page* 52.)

W. McDougall, moulder, Mavor & Coulson, Limited.

R. Macnaughton, foundry foreman, Bertrams, Limited, Edinburgh.

M. N. Samanta, castings examiner, Indian Stores Department, E.I.R.

W. Smith, foreman moulder, Carron Company, Falkirk.

J. Sneddon, foundry foreman, W. J. Brunton, Dalkeith.

A. U. Turnbull, foreman moulder, Smith & Wellstood, Limited, Bonnybridge.

D. Webster, moulder, Barr & Stroud, Limited, Anniesland.

A. L. Gardiner, moulder, C. Binks, Limited, London, E.14.

C. Powney, moulder.

H. W. Saunders, metal mixer, Specialloid, Limited.

H. Jackson, moulder, W. Dickinson & Sons, Blackburn.

G. H. Copeman, foreman patternmaker, J. & H. McLaren, Leeds.

J. A. Donaldson, metallurgist, The Carron Company, Falkirk.

F. Hardy, foundry foreman, Barker & Haspey, Hull.

H. G. Hall, foundry metallurgist, Shotton Bros., Limited, Oldbury.

G. R. Shotton, assistant foundry manager, Shotton Bros., Limited, Oldbury.

W. Y. Buchanan, metallurgist, The Mirrlees Watson Company, Glasgow.

G. H. Newman, moulder.

Associates.

G. Baines, moulder, J. Dewhurst, Limited, Moorbrook Foundry, Preston.

E. S. Binns, apprentice moulder, J. Walton & Son, Limited, Nelson.

R. Hogg, apprentice moulder, T. Ashworth, Limited, Burnley.

H. Potter, moulder, J. Dewhurst, Limited, Moorbrook Foundry, Preston.

Moulding and Casting a 32-Ton Foundation Block.*

By G. E. Morgan.

Introduction.

This Paper is an endeavour to convey some idea of the methods in vogue in an Indian foundry, principally the means used in the moulding of a 32-ton foundation block for a steam hammer. The method used was the best available under the circumstances and conditions at the time. Before dealing with the subject proper, the following details of the East Indian State Railways' General Iron Foundry will, perhaps, be found interesting, and will give some idea as to its size, plant and equipment, as foundries out East are different from those in England. This foundry is one of the most up to date of its kind in India, and deals chiefly

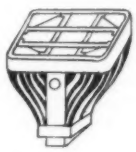


FIG. 1.—SKELETON PATTERN.

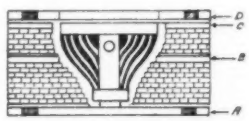


FIG. 2.—PLATES A, B, C, D.

with the manufacture of castings for maintenance of the railways' system. The output of castings averages 350 to 500 tons a month. This average deals only with general castings, and does not include permanent-way upkeep, *i.e.*, chairs, plates, etc., these being manufactured in "the permanent way foundry," which specialises in this class of work only.

The General Iron Foundry, Jamalpur, India, a newly-built foundry of steel structure and

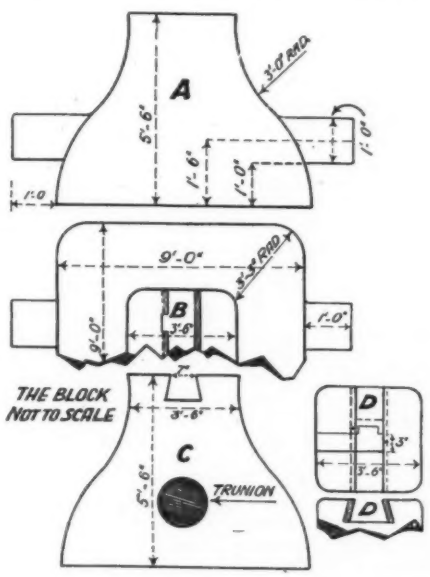


FIG. 3.—SIZES AND VIEWS OF BLOCK. (NOT TO SCALE.)

galvanised-sheet roofing, was erected by Messrs. Dorman, Long & Company, Limited, and is very well laid out, splendidly lit and excellently ventilated. It is 352 ft. long, 200 ft. wide and 48 ft. high, with an area of 70,400 sq. ft., and is comprised of four bays, the two inner bays being wider and higher than the two outer bays. The two inner bays are 60 ft. wide and the outer bays 40 ft. wide. In the west inner bay there are a 10-ton and a 3-ton overhead electric travelling crane by Sir William Arrol & Company, Glasgow, and Messrs. Babcock & Wilcox, Limited. In the east inner bay there are a 30-ton and a 10-ton Arrol overhead electric travelling crane. A battery of six mould and core drying stoves, gas fired, were situated in the east outer bay; these have now been converted into coke-fired stoves, and removed and set just outside the foundry in the east outer bay section. These new stoves will be more economical to work and obviate the frequent stoppages and breakdowns as was experienced when using gas-producers. Placing them just outside the foundry proper will now provide extra floor space for moulding and give cleaner working in the foundry.

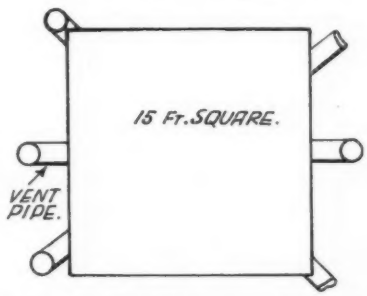


FIG. 4.—THE BED MADE, WITH VENT PIPES SET IN READY FOR MARKING OFF.

Four 36-in. dia. cupolas are situated at the south end of the shop, and are worked by "Sirocco" fans supplied by Messrs. Davidson, of Belfast, at 12½ ozs. pressure at 2,240 r.p.m. The charging platforms to the cupolas are served by two "Thwaites" electric hoists of 2 tons capacity.

As the foundry is extensively engaged on repetition work, a large number of hand-ram turnover machines are in use, as well as a number of jar ram pneumatic machines for small work. These are to be augmented in the near future by the installation of power moulding machines in the west inner bay, and a mould-conveying unit

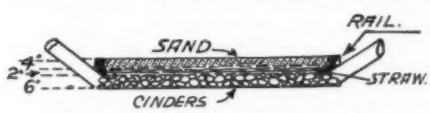


FIG. 4A.—SECTION THROUGH BED.

to be installed in the west outer bay. This bay also contains a sand drying, reconditioning and distribution plant; this has just been installed by Messrs. A. Baillot & Company, of Paris. As this has been done since his departure on leave, the author is unable to give any information as to its capabilities.

The core section is at the north end of the east outer bay, and is a separate unit; here cores of every description are made by respective core-makers who specialise in particular types of cores. As far as possible, specialisation is carried out throughout the foundry. The work in the core section, as far as possible, follows the working of the foundry, is set work, *i.e.*, so many cores per day per man. The sand mixtures in use in the core section are sands mixed with "Glyso" linseed, flour or cow-dung, the class of mixture depending on the nature of the job in hand. At the north end of the west outer bay lies the fettling section; this is complete with a battery of four rumblers, grinders, a pipe-testing machine, pneumatic lines for fettling and a small sand-blast arrangement. A new sand-blast unit is being installed by Messrs. A. Ouderville & Company, France. In the west outer bay there is also a fitting section, complete with drilling machines, etc., for maintenance of foundry plant and tackle-making. The foundry throughout is served with pneumatic lines, and practically every moulder is able to use compressed air for cleaning out his moulds, etc. Sand for the foundries' use is prepared in two mills located at the north end of the east outer bay. These are supplemented by a bowl-mixer for facing sands and a mill for coal-dust grinding.

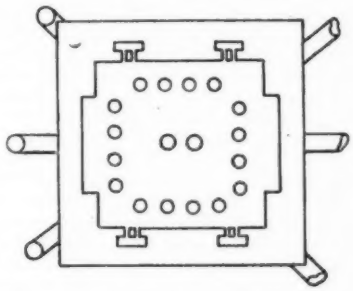


FIG. 5.—PLATE MARKED OFF AND LIGHTENING CORES SET ROUND SIDES.

Raw Materials Used.

The moulding sands in use are river-bed varieties, and contain no bond, hence cow-dung and clay have to be used to give the necessary bonding. The sands are "Oyria," a coarse-grained red sand, and "Kiul," a smaller-grained yellow

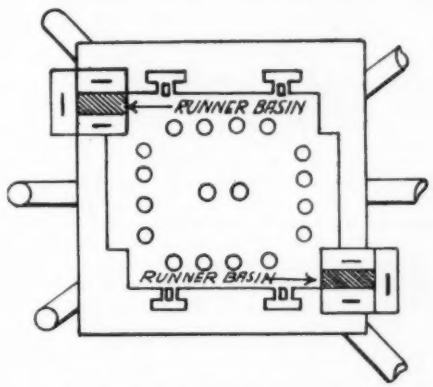


FIG. 6.—PLATE READY FOR CASTING.

sand. These are mixed with a red clay obtained locally. The irons now used are "Mysore," a high-silicon charcoal pig-iron, and "Burns" Nos. 3 and 4 pig-irons, the analyses of which are given in Table I.

TABLE I. *Composition of Irons Used.*

	Mysore.	Burns 3.	Burns 4.
Gr	2.85	—	—
C.C. ..	0.48	—	—
Si	2.56	1.75—2.25	1.50—1.75
Mn	1.4	1.0—1.5	1.0—1.5
S	Trace	0.04	0.05
P	0.075	0.3—0.4	0.3—0.4

The following mixtures are in use:—

General Castings.—Mysore, 10; Burns No. 3, 20; shop scrap, 35; and line scrap, 35 per cent. This yields the following composition:—Gr, 2.60; C.C., 0.51; Si, 2.13; Mn, 0.53; S, 0.05; and P, 0.61 per cent.

Locomotive Castings.—Mysore, 10; Burns No. 3, 20; shop scrap, 30; and line scrap, 40 per cent. This gives the following composition: Gr, 2.95; C.C., 0.2; Si, 2.41; Mn, 0.76; S, 0.035; and P, 0.65 per cent.

* A Paper read before the Wales and Monmouth Branch of the Institute of British Foundrymen, Mr. R. J. Richardson presiding.

Cylinder Castings.—Burns No. 4, 5; line scrap, 10, and steel scrap 1½ cwts. From this the following composition is given:—Gr. 2.75; C.C., 0.54; Si, 1.56; Mn, 0.54; S, 0.04, and P, 0.44 per cent.

The fuels, coal and coke are much inferior to those in use in this country, but, of course, are much cheaper. Due to high ash content, the melting efficiency is not nearly so high as obtained in Britain.

Earlier reference was made to the foundries out East being different; briefly, the differences are: Spaciousness—the height being particularly noticeable—and the open ends and sides. The reasons for the foundries being open and spacious are fairly obvious; the hot seasons would make work in the foundry unbearable if they were closed in. The openness, giving greater ventilation and better lighting, is essential. Another point to remember is—the Indian moulder likes plenty of room in which to work. Methods of working are different, as are also the sands. The Indian moulder in his way, although slow, is quite as skilful as his Western colleague. His wearing apparel is of the scantiest, a loin-cloth, or "Dhotie," and a long cotton shirt sufficing. At times he even dispenses with the shirt and wears only the "Dhotie," or loin-cloth. In the foundry bare feet are the fashion. This even applies to the ladlemen, yet they appear immune from burns, casualties from burns being few and far between. At his work the native moulder often uses his feet (as do other craftsmen) to supplement his hands, and he is quite an expert at it. The tools he uses are the simplest and few in number—a trowel, a cleaner or two, a strip of wood, a wet brush and a mug or bucket comprising his "kit."

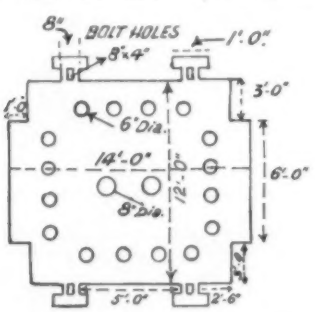


FIG. 7.—FINISHED BOTTOM PLATE.

32-Ton Foundation Block.

Coming to the subject proper, the making of the block, a 32-ton casting is by no means an easy job to undertake without due thought and careful consideration. The pattern for the job was of skeleton type, and it was decided to make the job a brick and loam one on plates, in its own pit, with the small-end down. Tackle was obviously going to be the biggest problem, and, in fact, the chief item. Before a start could be made on moulding, tackle would have to be made first to cover the whole of the job from start to finish, and it was this that took the time and proved the task. The pattern was measured up, its approximate weight calculated, the weights of risers and heads added and the positions of runners and risers decided on. Due to its huge size, suitable boxes were out of the question, so it was decided to cast four iron plates and build the job up on them, the four plates being: (*a*) *bottom or foundation plate*; (*b*) *the mid-plate*; (*c*) *the joint plate*; *and* (*d*) *the top plate.*

Figs. 1 and 2 show the skeleton pattern and the method decided upon for making the job, using the plates *a*, *b*, *c*, *d*.

Making the Bottom Plate.

The first item of tackle to be made was the bottom plate. This would have to be made strong enough to carry the whole of the job (no small item) and also bear the strain of clamping it down. The overall size of the top of the pattern was 11 ft. by 9 ft., the plate would therefore have to be big enough to carry in addition to the job itself, all the necessary brickwork for it. Consequently allowing 1 ft. 6 in. clearance outside the pattern, the plate must be at least 14 ft. by 12 ft., and at least 4 in. thick, with lugs for handling and bolting down purposes. The other three plates would naturally have the same overall length and breadth sizes. To make this huge plate, the floor was dug out 15 ft. square and 1 ft. in depth. Levelling the bottom off roughly, coke and cinders were rammed in to a height of 6 in., and upon this a 2-in. layer of straw was laid. Six long 6-in. dia. tubes were let in to take away the gases and steam. The old sand, strengthened with new, and an addition of fine coal dust, was riddled and rammed up. On the surface a half inch layer of fine facing sand was rammed in, and the bed, vented all over, was well sprigged. To ensure accuracy in striking off the bed, two old steel rails were used. The plate was marked off correctly and allowances added for contraction. Round the plate for venting purposes sixteen 6-in. cores were set (four cores a side). In the centre of the plate, two 8-in. dia. cores were placed to enable the dovetail core to be bolted down in its print.

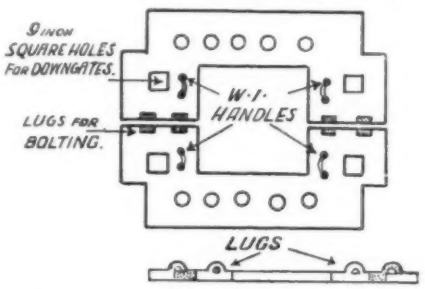


FIG. 8.—FINISHED MID-PLATE AND SECTION.

Making the Middle Plate.

The next item was the making of the mid-plate. Unlike the bottom plate this was made in two pieces to facilitate handling, when placing in position, at the half-way stage of building up the block. To have made it a one-piece casting would have been useless, as the size of the block at the half-way stage would not be that of the top. It would have to follow more closely the size of the mid portion of the pattern. As there would be very little strain on this plate, the mid-plate was made only 2½ in. thick, ten 8-in. dia. cores were let in for lightening and venting purposes, four 9-in. square cores for the down-gates positions; four lugs on each half for bolting, and two wrought-iron handles for lifting on each half were cast in. The weight of the finished mid-plate was approximately 4½ tons.

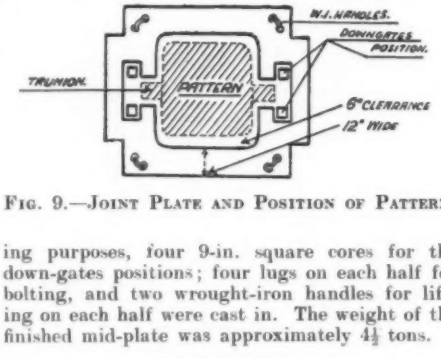


FIG. 9.—JOINT PLATE AND POSITION OF PATTERN.

The Joint Plate.

The joint plate was made in one piece, only 2 in. thick. For working purposes and clearance 6 in. was allowed round the pattern. This plate closely follows the shape of pattern, and Fig. 9 shows the finished plate. The dotted lines indicate the outline of the top of the pattern, and will explain the reason for the peculiar shape of the plate. Wrought iron handles had to be cast in the corners for convenience and balance. The weight of this plate was approximately 2½ tons.

The last of these items was the top plate. This, having to carry the heads, risers, runner boxes, weights, plus the strain of clamping, and the strain of a huge body of metal in its upward expansion tendency, and to prevent fracturing and drawing down as the metal cooled, was made a little stronger than the bottom plate. This was made 5 in. thick (the bottom was 4 in.), and even this thickness did not prevent the plate cracking—fortunately, without any damage to the casting. Other differences in the top plate from the bottom plate were four large loam-cake cores, 9 in. square, which were set for the runner positions; six 9-in. dia cores for the riser positions; and in the centre a 2-ft. square loam cake to take the main feed head. Four W.I. handles, 2-in. dia., were cast in, and 3-in. prodders were made all over the plate to enable the loam to adhere. The approximate weight of the top plate was 12½ tons.

(*To be concluded.*)

Institute of Metals.

ANNUAL GENERAL MEETING.

The twenty-fourth annual general meeting of the Institute of Metals will be held, by kind permission, in the Hall of the Institution of Mechanical Engineers, Storey's Gate, London, S.W.1, on Wednesday and Thursday, March 9 and 10.

The annual dinner will be followed by a dance, which will be continued until 1 a.m. Pilbeam's Band has been engaged. The price of tickets for the dinner and dance—exclusive of wine—is 15s.

Election of Council

As only sufficient nominations to fill the vacancies announced at the last general meeting have been made, no ballot will be necessary, and the following members, who have been nominated for election on the Council, will be declared to be duly elected at the annual general meeting on March 9:—

President.—Sir Henry Fowler, K.B.E., LL.D., D.Sc.

Vice-Presidents.—Mr. W. R. Barclay, O.B.E. (London), and Dr. H. Moore, C.B.E., D.Sc., Ph.D. (Woolwich).

Members of Council.—Mr. Maurice S. Gibb, C.B.E., J.P. (West Hartlepool); Mr. R. Lloyd Gibbins (Birmingham); Mr. E. L. Morcom, M.A. (Birmingham); Mr. James Steven (Glasgow); Mr. W. G. Turner, O.B.E. (Sheffield), and Mr. H. B. Weeks, F.I.C. (London).

Papers to be Presented.

"Magnesium Alloy Protection by Selenium and Other Coating Processes," by G. D. Bengough, M.A., D.Sc., and L. Whitby, M.Sc.

"The Influence of Temperature on the Elastic Behaviour of Various Wrought Light Metal Alloys," by Dr.-Ing. F. Bollenrath.

"Some Bronze Specimens from the Royal Graves at Ur," by C. F. Elam, M.A., D.Sc.

"The Relative Corrodibilities of Ferrous and Non-Ferrous Metals and Alloys. Part III.—Final Report. The Results of Three Years' Exposure at Southampton Docks," by J. Newton Friend, D.Sc., Ph.D.

"The Age-Hardening of Some Aluminium Alloys of High Purity," by Marie L. V. Gayler, D.Sc., and G. D. Preston, B.A.

"The Behaviour of Single Crystals of Bismuth Subjected to Alternating Torsional Stresses," by H. J. Gough, M.B.E., D.Sc., Ph.D., and H. L. Cox, B.A.

"The Thermal Conductivity of Some Non-Ferrous Alloys," by Prof. D. Hanson, D.Sc.

"The Properties of Copper in Relation to Low Stresses (the Effect of Cold-Work, Heat-Treatment and Composition). Part I.—Tensile and Compression Tests under Short-Time Load-

(*Concluded on page* 64.)

Deoxidisers and Fluxes.

By G. L. Bailey, M.Sc.

(*Concluded from page 6.*)

Behaviour of Common Deoxidants.

Phosphorus is usually added as a copper-phosphorus alloy containing 10 to 15 per cent. phosphorus in which it exists as the compound copper phosphide. It is very successful in deoxidising copper itself and is largely used to obtain sound castings in pure coppers owing to the effect of its deoxidising action in suppressing the reaction between cuprous oxide and dissolved hydrogen on solidification. The actual mechanism of the deoxidising action is supposed by many to be the volatilisation of phosphorus pentoxide, certainly this oxide is volatile at the temperatures of molten copper, but there is a number of reasons why it is not thought that the oxide is merely volatilised. Of these the main one is the comparatively small amount of phosphorus eliminated in the deoxidising reaction. If this proceeded solely according to the equation resulting in the formation of phosphorus pentoxide, then 0.1 per cent. phosphorus would be utilised in the removal of 0.13 per cent. oxygen; actually it is found in practice that the proportion of phosphorus used is considerably less than this. Apart from this, evolution of oxide fumes when the phosphorus is first added is not generally noticeable, and probably these facts can only be explained by assuming that the phosphorus pentoxide formed combines with a further amount of cuprous oxide to form a fluid phosphate slag, which is usually visible in small amounts on the surface of the molten metal. Its extreme fluidity is responsible for the fact that it separates readily from the molten metal.

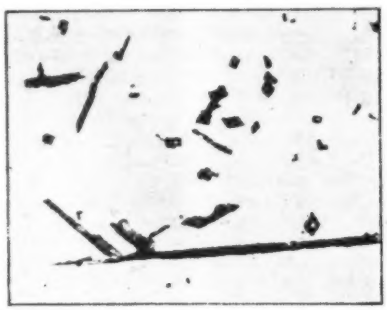


FIG. 1.—TIN OXIDE INCLUSIONS IN BRONZE.

FIG. 2.—INTERCRYSTALLINE FILMS OF TIN OXIDE.

FIG. 3.—ZINC OXIDE INCLUSIONS IN BRASS.

In addition to its use with copper, however, phosphorus is, of course, largely used as a deoxidant for many copper alloys. In the case of the silver and gold alloys the oxides present are probably those of the base metals in the alloy, usually copper, and the action of phosphorus will be similar to that on pure copper. When the alloy contains tin or zinc, however, the reactions are to a certain extent doubtful. It has been stated by several authorities that phosphorus is not capable of reducing tin or zinc oxide. It is an undoubted fact, however, that when sufficient phosphorus is added to a badly-oxidised brass or bronze alloy the surface of the metal clears from its oxide skin and has all the appearance of being properly deoxidised. On the other hand, it is equally undoubted that inclusions consisting more or less of tin and zinc oxides have in some cases been found in alloys containing phosphorus. It has been stated that such beneficial influence as phosphorus does exert in these cases is due to an increase in the temperature and a decrease in the viscosity of the bath, though why thermal changes should occur on the mere addition of phosphor copper and in the absence of any deoxidation reaction is obscure. Probably Falkenstorfer[4] is correct in stating that phosphorus will deoxidise zinc and tin oxides provided the states of aggregation of these substances bring them into sufficiently close contact. The occurrence of tin-oxide inclusion in a phosphor-bronze is due to its balling-up into comparatively large particles which are removed from the reducing action of the phosphorus subsequently added. The only satisfactory method, therefore, of securing brass or bronze melts free from oxide by the addition of phosphorus is to deoxidise the copper before adding zinc or tin. In the case of bronzes and brasses it is suggested that the majority of the oxide is removed by the formation of a fluid phosphate slag, though containing in these cases tin or zinc also as the metallic radicals.

Phosphorus possesses one great advantage over other deoxidants in that it appears to prevent, even in the case of brasses and bronzes, oxidation of the surface of the stream during pouring. It has been suggested, to explain this phenomenon, that the volatile phosphorus is being continually evolved from the molten metal and forms an envelope of reducing gas around the stream. This explanation seems to be extremely improbable. It is true, of course, that phosphorus has a low boiling-point, but as far as is known it exists in solution in molten copper, and therefore, being in such small amounts, its partial pressure will be extremely low. Furthermore, the loss of phosphorus on remelting a phosphorus brass or bronze under reducing conditions and recasting is small and does not suggest any continuous evolution of this element. It is suggested that the absence of an oxide skin on these materials in the molten condition is explained by the fact that such oxidation products as are formed are of the molten phosphate type and not that surface oxidation is entirely inhibited.

Whilst discussing phosphorus reference has been made to the fact that zinc and tin, though actually deoxidising copper, are liable to result in the retention of their respective oxides in the casting. Inclusions of tin oxide are definitely harmful. The material is hard, and is liable to damage cutting-tools during machining or, where the alloy in question is a bronze bearing, to score the steel shaft. A photomicrograph of tin-oxide inclusions in bronze taken from Comstock[5] is shown in Fig. 1. Tin oxide does not form any fluid slag in the absence of other deoxidants, and these small solid particles therefore remaining in the casting as such do not tend to aggregate, and, although their density is lower than that of liquid bronze, do not appear to levitate to any great extent. Absence of tin oxide can only be ensured by deoxidising before adding tin, and this difficulty in separating tin oxide as such from the molten metal renders it practically valueless as a deoxidant. It is sometimes stated that tin oxide occurs as intercrystalline films such as those shown in Fig. 2 (Comstock). It seems somewhat unlikely that such films are of stannic oxide when they are compared with the inclusions shown in Fig. 1, and Comstock is probably correct in attributing such defects to gases rather than oxide films. Inclusions of zinc oxide are not encountered in cases where no other deoxidant is used to anything like the same extent as tin oxide, and in fact it has been found very difficult to obtain brass castings containing zinc oxide when deliberately trying to do so. Comstock also experienced great difficulty in doing this, but succeeded finally by adopting extreme measures, and the photomicrograph (Fig. 3) of zinc oxide inclusions in a brass is again taken from his Paper. From this photograph it appears that the inclusions are more rounded and show less crystalline form than those of tin oxide. It may be that zinc oxide is capable of reacting with other oxides at high temperatures to form fluid zincates, but whether this be the case or whether for some reason solid particles of zinc will levitate readily there is insufficient evidence to decide. The statement that zinc oxides has a low boiling point and therefore volatilises readily is certainly erroneous. Whatever the mechanism of the removal of the oxide it is certainly true that zinc forms a fairly satisfactory deoxidant and its use as such in gun-metal is well known, though there is some evidence that deoxidation with zinc is not quantitative. For similar reasons to those stated in the case of phosphorus, zinc frequently does not completely remove tin oxide from a bronze, and it is therefore advisable when making up gun-metals to add the zinc first.

Of the other generally used deoxidants manganese is probably the most important. It is less generally useful than phosphorus owing largely to its inability to prevent the formation of an oxide skin during pouring, and it is mainly used for alloys in which the beneficial effects of residual manganese are required or where residual phosphorus is definitely harmful. The oxidation product of manganese, manganese oxide, though having a high melting point in itself, forms a fluid slag with other oxides including silica from the crucible, etc., which is readily removed from the melt. Comstock has been unable to find non-metallic inclusions in copper deoxidised with manganese. Though not strictly within the province of a deoxidant, it may be mentioned that manganese in certain cases also exerts a beneficial effect by the removal of sulphur. In the casting of nickel and its alloys so-called " deoxidation " is carried out by the addition of manganese followed by a little magnesium. Nickel oxide is soluble in molten nickel and is doubtless removed by this treatment, but the resulting improvement in the

[4] Falkenstorfer. " Metallwirtschaft," **10**, 1931, 130.
[5] Comstock. Trans. Amer. Inst. Min. & Met. Eng., **60**, 1919, 386.

malleability of the metal has been shown by Merica and Waltenberg[6] to be due to the reduction of the sulphide of nickel rather than its oxide. Silicon as a deoxidant is very similar to phosphorus in its behaviour. It has a powerful affinity for oxygen and the resulting deoxidation products form fluid silicate slag. Comstock for this reason found he could not prepare specimens with silica inclusions by adding silicon to oxygen containing copper. The results of such additions always gave him areas of slag of which

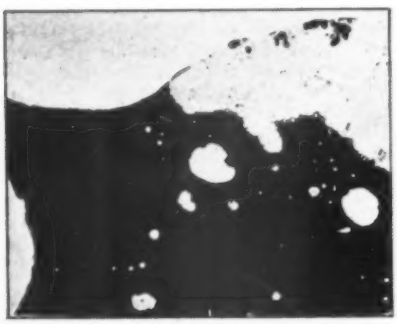


FIG. 4.—AREAS OF SLAG.

Fig. 4 is a typical photograph. No personal information is available as to the composition of this slag, but Kahlenberg and Trautmann[7] have shown that by heating copper oxide and silicon in an electric arc a slag is formed for which they suggested the formula $CuSiO_3$.

Boric oxide forms fluid borate slags with certain other metallic oxides, but in many cases, notably aluminium and tin, it has been stated by Burgess and Holt[8] that the oxide is quite insoluble in fused boric oxide. It cannot therefore be assumed that the addition or formation of boric oxide will result in a fluxing of other oxides present, and each case must be considered on its merits.

Of the other oxides to which reference has been made earlier, one of the most important in non-ferrous foundry work is that of aluminium. Aluminium has a very high affinity for oxygen, and it is difficult to prevent the formation of alumina if this metal is present in the particular alloy. Aluminium, however, is worse than useless as a deoxidant in the majority of cases. The alumina formed remains as such and does not combine readily with other oxides to form slag. It is very difficult, in fact, in ordinary foundry work to keep this oxide out of the casting if aluminium is present in the alloy, either in small amounts or as the major constituent. Fig. 5 shows a photomicrograph of alumina inclusions in aluminium bronze, again taken from Comstock. Inclusions of this type, while decidedly detrimental, are actually less harmful than when the oxide occurs in films due to splashing or folding of the metal during pouring. The presence of phosphorus in the alloy does not affect the formation of alumina, in fact there is reason to believe that at high temperatures aluminium will even deoxidise carbon monoxide. The removal of alumina from a liquid metal is a matter of such difficulty that it is important to avoid its formation throughout the melting and casting operations by: firstly, deoxidising the metal thoroughly before adding aluminium, if possible, and secondly, casting in such a manner that the oxide skin, unavoidable on the surface, does not become entangled within the casting.

Of recent years the use of the alkali and alkaline earth metals has been suggested for the deoxidation of certain special materials. In connection with the production of deoxidised copper of high conductivity, lithium and calcium have been found to deoxidise cuprous oxide satisfactorily and their oxidation products appear at least to exert no harmful influence on the final material. Sodium has been suggested as a useful deoxidant for aluminium and its alloys, but while being open to correction on this point, the author is somewhat sceptical as to its value.

Reviewing finally the behaviour of these deoxidants in the light of the preliminary remarks, it would appear that in many respects the figures for the heat of formation of oxides are roughly of the same order as the affinity of the metals for oxygen. This agreement, however, is regarded as largely fortuitous, and it seems desirable to emphasise the danger of accepting the heats of formation as definite comparative values in a way that so many writers have done. That this danger is real is shown by the cases of zinc and phosphorus. Reference has already been made to practical observations which suggest that phosphorus has a rather higher affinity for oxygen at high temperatures than zinc, but the heats of formation suggest that the reverse is the case. With reference to the question of ease of removal of the oxidation products, phosphorus, manganese, silicon and boron are in this respect examples of satisfactory deoxidants in many cases, and it is interesting to note that with each of these deoxidants the oxides form a fluid slag with excess of the cuprous or other original oxide. This, of course, has the additional advantage of securing an increased deoxidising effect for a given weight of deoxidant. Aluminium and tin, on the other hand, are examples of metals with a comparatively high affinity for oxygen which are valueless as deoxidants on account of the difficulty of removing the resulting oxide, and this it is suggested is due almost entirely to the fact that the oxide remains in the metal in solid particles which are unable to aggregate into sufficiently large units to float out of the bath.

Deoxidation by Reducing Gases.

It is known that hydrogen is capable of reducing cuprous oxide in copper provided the material is heated with excess of the gas, but a sound casting can only be obtained from such deoxidised metal if the dissolved hydrogen is subsequently removed or if the material is cast

FIG. 5.—ALUMINA INCLUSIONS IN ALUMINIUM BRONZE.

in such a manner that the solution of oxygen from the air during the pouring operation is avoided. The recent development of electric furnaces, particularly of the high-frequency type, enables the atmosphere in contact with the metal to be controlled, and by the use of such furnaces copper can be melted and cast in an atmosphere of hydrogen with the production of a sound ingot. Dr. Smithells and his colleagues[9] have applied similar methods with success to the casting of nickel-chromium alloys and have found that if all oxides in these materials are reduced by hydrogen and the metal then allowed to solidify in an atmosphere of hydrogen, ingots of high density can be secured. Alternatively, after deoxidation with hydrogen and displacement of the hydrogen atmosphere in the furnace by nitrogen, they have obtained material which can be poured satisfactorily in air in the usual manner. Similarly, carbon monoxide has been shown to act as a satisfactory reducing agent for a number of metallic oxides, and in this case Maier[10] has worked out thermo-dynamically the equilibrium relation between cuprous oxide and carbon monoxide in liquid copper at the melting point. Direct reduction of the oxides in liquid metal by carbon monoxide has not, to personal knowledge, been applied in the same manner as reduction by hydrogen, but carbon-monoxide

FIGS. 6, 7 AND 8.—EFFECT OF $TiCl_4$ ON THE SOUNDNESS OF SILICON-ALUMINIUM ALLOY.

6 Merica & Waltenberg. Trans. Amer. Inst. Min. & Met. Eng. January, 1925, No. 1398–E.
7 Kahlenberg and Trautmann. Trans. Amer. Electrochem. Soc., 39, 1921, 377.
8 Burgess & Holt. Proc. Chem. Soc., 19, 1903, 221.
9 Smithells, Williams & Greenwood. Inst. Metals Advance Copy No. 582, 1931.
10 Maier. U.S. Bureau of Mines, 1929. B.N.F.M.R.A. Serial 2926.

reduction forms the principle of a novel deoxidisation process suggested by Reitmeister.[11] In Reitmeister's method, melts are made more or less oxidised in the first place, thus avoiding the solution of reducing gases. Excess oxygen is then removed by the addition of so-called flux consisting of metallic oxide and carbon. This mixture reacts at the temperature of the metal bath and produces carbon monoxide, which is the active agent in removing excess oxygen from the bath as insoluble carbon dioxide. If excess reducing agent is added the properties of the material are adversely affected and the melt is then in the condition described by Reitmeister as "over-carbonised." This state of affairs can be corrected by adding an oxidising agent and finally deoxidising again with the flux mixture. The author has had no experience of this particular method of Reitmeister's, but it appears theoretically sound, the only difficulty envisaged is in judging from the original condition of the metal the correct amount of either oxidising or reducing agent to be added.

FLUXES.

The term fluxes, as applied to non-ferrous melting practice, is used to cover salt mixtures which are applied for a very wide variety of purposes, of which the following are the most important: (1) Solvents for metallic oxides, (2) inert covers to protect the metal from oxidation and gas absorption, (3) materials for the removal of impurities other than oxygen by either solution or reaction, (4) volatile salts which remove inclusions by mechanical action and (5) degasifiers. Fluxes used for welding and soldering necessarily come in the first two of these categories only; that is, they are solvents for metallic oxide as well as providing a cover to protect the heated metal from oxidation.

Knowledge on the subject of fluxes used in the non-ferrous metal industries is almost entirely empirical, and, in spite of their importance, little has yet been done to establish a scientific basis for their selection. Fluxes have been adopted as the result of a process of trial and error, and it is sometimes found that comparatively unsuitable mixtures are in use owing to the absence of a clear idea as to their actual function. It is on account of this lack of accurate scientific knowledge that an enormous variety of such materials has not only been proposed but is actually in use, and new proprietary mixtures are continually being put forth whose action is in many cases almost identical with that of long-established and generally-used materials.

Fluxes which are required for purification and protective purposes must obviously have the power of dissolving or combining with the impurities which it is desired to remove, such as oxides, iron, etc. Surface tension is also regarded as one of the important properties of a flux, but the absence of accurate knowledge of the surface tension of pure substances and mixtures and especially of the interfacial tension between metal and flux makes it impossible to discuss the particular effect of this factor. It is only possible to say in a general way that the flux must obviously "wet" the surface of the metal. Viscosity of the molten flux and the resulting slag is also important, and it is probably correct to say that viscosity should be low in order to give easy aggregation in the melt or good covering power in welding. A flux which is too fluid to be removed easily before pouring can generally be corrected by adding some stiffening agent before skimming.

In considering the fluxes used in melting practice, it will be most convenient to divide the field to be covered roughly into two parts, taking, firstly, the high melting-point materials, such as copper, nickel and their alloys, and, secondly, those of lower melting point, such as aluminium and magnesium.

An enormous variety of fluxes has been suggested for use with copper and its alloys, and some of these are probably largely valueless. Those most generally satisfactory, both as solvents for metallic oxides and as covers to protect the metal from oxidation, are undoubtedly the compounds of boron. Borax or boric acid are largely used in the crucible melting of both copper and nickel alloys, and owe their success to the power possessed by boric oxide of combining with other oxides to form a fluid slag—a slag so fluid in some cases that it has to be thickened up with sand before it can be satisfactorily skimmed. In certain cases where boric oxide will not dissolve other oxides, as referred to when considering deoxidants, the addition of another soluble oxide, such as that of sodium, frequently brings about the desired result, and borax is, therefore, in general more satisfactory than boric acid. Boric oxide is, however, capable of attacking silica, and when used in crucible practice results, therefore, in considerable corrosion of the crucible. This can be diminished by the use of boro-calcite, which is an efficient solvent for the more easily-reduced oxides and is probably the most satisfactory of the boron compounds for use as a flux in this type of work. Boric acid is sometimes used mixed with alkali carbonate, and it is claimed that such a mixture is superior in practice to borax, but it is difficult to see how this can be the case, and borax is the cheaper material. Excess of an alkali carbonate certainly has a fluxing action in itself, owing, possibly, to the formation of fusible slags with any acidic or or amphoteric oxides which may be present. It is known, for instance, that zinc oxide is soluble in molten sodium carbonate, but tin oxide is not. Sodium carbonate is, therefore, used successfully as a flux in brass melting, generally in the crude form as soda ash. It forms a very fluid slag, but is somewhat severe on the crucible.

A material which is frequently used for high-melting-point alloys and whose actions is largely thought to be that merely of a protective cover, is glass. The cheaper varieties of green glass which have a comparatively low melting point are undoubtedly very satisfactory from this point of view, but it should not be forgotten that glass is also a solvent for metallic oxides and can therefore in certain cases be used as a deoxidising flux also. Its high viscosity is probably a disadvantage from this point of view, but preliminary experiments reported by Genders and Haughton[12] have suggested that under certain circumstances a green bottle glass may be an even better solvent for zinc oxide in an oxidised brass than is borax. Glass is also stated by Ebell[13] to dissolve considerable quantities of alumina. In the case of brass melting special merit is frequently claimed for a flux in that it reduces the volatilisation of zinc, but this action can be regarded as very largely mechanical and almost any continuous cover is more or less satisfactory in this respect, as long as the partial pressure of zinc in the alloy is below atmospheric pressure. In fact, Genders[14] has emphasised the fact that a film of aluminium oxide on the surface of a brass containing aluminium decreases the zinc fume considerably. A flux which is largely used in brass melting and of which the action is somewhat obscure is common salt. This material has the advantage of being extremely cheap and readily fusible, but volatilises fairly rapidly at the temperature of molten brass. Its vapour pressure is insufficiently high to enable it to be classed as a degasifier, and it is probable that the unvolatilised salt merely acts as a cover.

A number of fluxes is available commercially at the present time which are claimed to remove small amounts of undesirable constituents such as aluminium, silicon, iron, etc., from the alloy. Such readily oxidisable materials as aluminium or silicon can be largely oxidised out by the addition of an oxidising agent, and the fluxes in question as far as they are effective succeed for this reason. They comprise oxides such as those of copper and manganese with or without true flux like borax, but when used with alloys such as bronze or brass which contain a readily oxidised constituent the oxidation of the impurities is accompanied by a considerable loss of zinc or tin. It is claimed, therefore, that in cases of this sort preferential oxidation of aluminium for instance can be secured by a treatment with a less active oxidising agent, such as sulphate. Potassium sulphate has been recommended by Thews[15] as the most satisfactory for this purpose. For the removal of iron, particularly if present as iron carbide, Thews recommends the treatment with a quartz-soda slag or with mercuric chloride.

Finally, as far as high-melting metals are concerned, oxidising fluxes are recommended from time to time as degasifiers. The principle of removing reducing gases such as hydrogen from solution by the addition of an oxidising agent has already been referred to indirectly in discussing Reitmeister's deoxidation method. Where the oxide is in solution, as it is in the case of cuprous oxide in copper, the addition of excess oxide undoubtedly results in the evolution of the majority of the hydrogen as steam. It is not at all certain, however, that the stirring into the melt of an insoluble oxide is equally effective. Portevin states that the addition of litharge or red lead to a gassy gunmetal results in a considerable decrease in the volume of dissolved gas, accompanied by a reduction of the lead oxide to metallic lead which passes into the melt. Other oxides, particularly manganese dioxide, are claimed to bring about the same results, and the evidence that these materials are satisfactory for this purpose in certain cases appears unanswerable. There are, however, reasons for thinking that such materials are not always satisfactory. Whether this depends merely on the nature of the dissolved gas, or on the condition under which the treatment is carried out, are matters on which further evidence would be very valuable.

Fluxes for Aluminium, Magnesium and Light Alloys.

The removal of aluminium oxide from melts of the pure metal or its alloys is one of particular difficulty owing to the refractory nature of the oxide and its similar density to that of molten aluminium. Separation of metal and oxide, even in the surface layers, is very difficult, and it is often found that dross, skimmed from an untreated melt, may contain as much as 95 per cent. aluminium. It has already been indicated that to the best of personal knowledge no deoxidiser is satisfactory for reducing the alumina, and its removal can therefore only be brought about by a solution process. Fluxes which dissolve aluminium oxide usually contain as the active agent fluorides, mainly those of the alkali metals or double fluorides such as cryolite. A comparatively small proportion of fluoride is mixed with inert solvent materials such as chlorides, and the actual composition of these solvent fluxes is to a certain extent similar to that of aluminium welding fluxes except that the melting point is generally higher. Fluorides certainly seem to be the only materials which are capable of dissolving alumina, and inert chloride mixtures are useful only as covers. An attempt is frequently made in aluminium practice to secure the flotation of the trapped dross by mechanical action. This is done by treating the melt with a salt which is volatile at the normal melting temperature, and which, when pushed below the metal surface, causes considerable agitation of the liquid and consequent removal of more or less of the included matter.

Fluxes of this type are mainly zinc chloride-ammonium chloride mixtures, though it is not suggested that these materials are entirely without chemical or other action. Certainly other

11 Reitmeister. "Giesserei," **16**, 1929, 945.

12 Genders & Haughton. Trans. Faraday Soc. **20**, 1924, 124.
13 Ebell. Dingler's Journal, **64** (220), 155.
14 Genders. J. Inst. Metals, **43** 1), 1930, 163.

15 Thews, "Metallurgist," June 26, 1931, p. 94.

materials which are purely gaseous at the melting temperature are found to exert very beneficial effects in the removal of dissolved gases from the melt. Chlorine and nitrogen gases are known to act in this way, and though they could hardly be called fluxes, they are interesting in that the mechanism of the gas removal is probably similar in these cases to that of the gaseous fluxes titanium tetrachloride, boron trichloride, etc. Where a gas is dissolved in a liquid the amount which will be retained by the liquid depends on the partial pressure of the gas in the atmosphere in immediate contact with the liquid. By passing an inert gas through a liquid metal, the partial pressure of the dissolved gas is reduced to a very low value, and the gas is, therefore, swept out of solution. When volatile salts, such as $TiCl_4$ or $BiCl_3$, are passed into a bath of molten aluminium, the salt reacts with the metal with evolution of gaseous aluminium chloride and solution of the metallic radical in the melt. The atmosphere of aluminium chloride sweeps away the dissolved gases and enables sound castings to be made. Figs. 6, 7 and 8 show the effect of $TiCl_4$ on the soundness of castings in silicon-aluminium alloy, and are taken from Rosenhain, Grogan and Schofield's Paper to the Institute of Metals, 1930.[16] The titanium passing into solution also produces a certain amount of grain refinement. It is probable that active fluxes of this type are also largely effective in removing non-gaseous inclusions, but whether their action in this case is chemical or physical is not known. Zinc chloride also reacts with molten aluminium with the production of aluminium chloride, and it is possible that zinc chloride actually exerts a purifying action to a certain extent similar to that of $TiCl_4$, and that its effect is not entirely mechanical.

Finally, as far as aluminium is concerned, reference must be made to certain types of chemically-active fluxes which "thermit" with the metal at a temperature of about 700 deg. C. and heat the surface layer to a considerably higher temperature. These fluxes contain two salts, one of low-melting point, which will start the reaction, and the other of higher-melting point, which retards the action when it becomes too violent. It has been mentioned earlier that the dross on the top of an unfluxed melt of aluminium alloy contains a very large proportion of free metal surrounded with films of oxide. These "thermit" fluxes enable the metal in the dross to separate and very largely reduce the wastage in the skimmings.

The fluxes used with aluminium and its alloys provide a very interesting case of the importance of avoiding the addition of moisture to molten metal with the flux—either hygroscopic moisture or water of crystallation. Some of the materials to which reference has been made, for example, zinc chloride, absorb water from the atmosphere very readily, and it is known that molten aluminium reacts rapidly with steam-producing alumina and hydrogen which is dissolved by the metal. It is obvious, therefore, that any materials to be added to the crucible should be thoroughly dried.

Magnesium is similar to aluminium in that it is very readily oxidised and the oxide is somewhat heavier than the metal. Suitable metallic deoxidants are again unobtainable and the use of a flux in melting is essential to ensure a clean casting. Magnesium chloride is a satisfactory solvent for magnesia and is the basis of the general fluxes used. It is, however, somewhat too fluid, and the addition of other salts is necessary to increase the viscosity. A typical mixture which proves satisfactory in service is anhydrous magnesium chloride 67.5 per cent.; potassium chloride 25 per cent.; sodium fluoride 4.5 per cent., and calcium fluoride 3 per cent. Magnesium is particularly readily attacked by water vapour, and, as magnesium chloride is very hygroscopic, it is advisable to dry the flux immediately before use. The sand-casting of magnesium alloys presents special difficulty on account of the unavoidable evolution of a small quantity of steam from the moulding sand on pouring and even in well dried moulds reaction between the metal and steam was found to occur. This is overcome by mixing with the moulding sand small quantities of sulphur, which is vaporised by the molten metal and partially burnt to SO_2. The resulting reducing atmosphere of sulphur vapour in the mould is found to enable satisfactory results to be obtained.

[16] Rosenhain, Grogan & Schofield. J. Inst. Metals, **44** (2), 1930 305.

Conclusions.

Reference to large numbers of materials which are used with more or less success has been omitted. This has been done deliberately, not only on account of considerations of space, but in order to concentrate rather upon well-known fluxes of which the actions are typical. An attempt has been made to show that in spite of a deplorable lack of accurate scientific knowledge of the mechanism of their action, certain types of fluxes are known which in general are capable of achieving certain desired ends. If the foundryman is able to form a clear picture of the function he requires his flux to fulfil, a selection can frequently be made from the more well-known materials of one which will be reasonably successful, and there is rarely any justification for employing materials of which the composition is a "secret" and the action entirely unknown. Dependence on an obscure flux to cure all troubles and to remove the harmful effects of unsatisfactory melting practice is fortunately becoming more uncommon as knowledge of the melting operation is increasing, and more reliance is rightly being placed on melting and casting technique and general cleanliness to ensure a minimum of contamination. Fluxes are, however, of particular importance in the melting of secondary metals, and there is a great need for careful research work not only to elucidate the action of the known and tolerably successful fluxes, but also to develop fluxes which will successfully overcome some of the difficulties which remain.

Sand-Blasting Developments.

At the December meeting of the Birmingham, Coventry and West Midlands Branch of the Institute of British Foundrymen a lecture was given by Mr. T. Fearnley Allen on "Modern Applications of Sand-Blast Plant." This Paper appeared in our December 17 issue. The Branch-President (Mr. F. J. Hemming) was in the chair, and there was a good attendance.

Vote of Thanks.

At the conclusion of the lecture a vote of thanks was proposed by MR. G. M. CALLAGHAN, who pointed out that steel shot for sand-blasting was very desirable from the hygienic point of view. There was a difficulty, however, in that steel was sometimes caught in the sharp corners of a casting and gave trouble with tool breakage on subsequent machining.

MR. E. J. LEWIS, seconding the vote of thanks, congratulated the lecturer on the impartial way in which the lecture had been given. He would like to ask if there were any difficulty in removing cores. For instance, did a tumbling barrel remove internal cores in an exhaust manifold? Was there any special method for handling cored castings on a rotary table? The vote of thanks was enthusiastically carried.

Action of Sand and Steel Shot.

MR. ALLEN replied that steel shot gave a peening action, while sand gave a scouring action with more cleaning. With regard to internal cores, these must be removed by hand, although for small castings such as gas and water cocks tumbling barrels would remove internal cores. The rotary table was satisfactory for ribbed and undercut castings but not for hollow castings as a full flow of air was necessary.

A MEMBER asked if it were possible to clean a casting 4 ft. long and 15 in. square in a cabinet, as, if the casting were laid in lengthwise, one end would be too near the nozzle. MR. ALLEN replied that a room was more generally used for such castings, but was much dearer.

The CHAIRMAN asked what were suitable pressures for cleaning steel castings in a tumbling barrel. He had found that high pressures gave improved efficiency. He thought that the use of sand-blast in foundry fettling operations was very desirable from the point of view of noise elimination. In reply to Mr. Hemming, the LECTURER stated that for steel castings the pressure should be not less than 45 lbs. and preferably 60 lbs.

Breakages in Tumbling.

MR. N. C. BLYTHE asked if excessive breakages were customary when cleaning thin light castings in a tumbling barrel. He was using 1 r.p.m. as compared with 2 r.p.m. recommended by the lecturer. What was the best speed and loading point for such conditions?

MR. ALLEN stated that with castings having lugs there was a tendency to lock and give a high distance of fall. There was also a tendency to lock under the nozzles with long castings. The best loading height was one-third up.

MR. G. R. SHOTTON asked if the rotary table was more efficient than the tumbling barrel from the power standpoint. Mr. Allen replied that the barrel was cheaper if the castings were suitable. The table gave slightly increased output but had heavier running costs.

MR. ROBERTS asked if there were any difficulty in cleaning heavy steel castings with deep pockets using 70 lbs. pressure. Could a man handle the hose easily and was there any danger from shot rebound? The LECTURER replied that 70 lbs. pressure was quite satisfactory for handling, although the shot rebound was sometimes a difficulty, especially with a cabinet, and therefore a room was to be preferred. Deep cores could be cleaned satisfactorily, especially if a turntable were used or if the castings were slung.

MR. A. E. LESTER questioned the lecturer regarding the cleaning of "Y"-shaped cores in castings 9 in. long and also dead-end cores. Could these be cleaned properly with low pressures?

MR. ALLEN replied that "Y"-shaped cores could not be dealt with suitably in a barrel. If cleaned in a cabinet it was best to plug one end of the casting to prevent the flow being broken up. With dead-end cores and wells it was best to blow out the dust with clean air after sand blasting.

Nozzle Distance.

MR. H. G. HALL asked if the distance of the nozzle (18 in.) in a rotary table depended on the pressure. What would be the distance for 60-lb. pressure for instance and was the distance the same for steel shot as for sand?

MR. ALLEN replied that the usual distance was 6 to 9 in. With a rotary table there was usually 15 in. curtain clearance, but in stove-plate work this could be reduced to 6 in., giving 6 to 8 in. nozzle distance. For general work, however, this small clearance would not be possible.

MR. R. WILSON asked for information as to the best type of dust arrester, *i.e.*, screen *v.* duplicate bags.

THE LECTURER replied that the bag was better as there was less upkeep and less tendency to clog. Moreover, the bag was cleaner to operate.

Water-Pollution Research.—The Department of Scientific and Industrial Research have issued Vol. V of the Summary of Current Literature relating to water-pollution research. It contains a section dealing with trade waste waters.

NEW!

"NEW PROCESS" PIG IRON

After many years of exhaustive research, we are now producing new process irons which have unique properties hitherto unobtainable in pig irons. "NEW PROCESS" irons enable the manufacturer to widen his field of business by the production of clean, tough and homogeneous castings of the highest quality.

NOTICE.

In the last issue the two tables below were transposed in error.

FOR GREY IRON CASTINGS

Grade	T.C.	Si.	Mn.	P.	S.
C7 ..	2.6/2.8	2.0/2.2	0.5/0.8	0.5/0.8	0.050
C1 ..	2.6/2.8	1.5/1.7	0.5/0.8	0.5/0.8	0.060
D2 ..	2.6/2.8	1.2/1.4	0.8/1.0	0.4/0.6	0.070
E1 ..	2.6/2.8	1.0/1.2	0.8/1.0	0.2/0.4	0.080
F2 ..	2.6/2.8	0.8/1.0	1.0	0.10	0.080

The above irons can be supplied with carbon from 2.8/3.0 or 2.6 maximum, and are only given as representatives of the grades manufactured. A complete list of the grades of "New Process" iron will gladly be sent on request.

Advantages :

1. **Low carbon** offsets the carbon pick-up experienced in remelting and ensures tough, close-grained, easily machined castings of remarkably fine texture.
2. **Extremely fine graphite,** owing to the iron being superheated in manufacture.
3. **Less shrinkage** in finished castings owing to the range of analysis offering a correct control of composition.
4. **High physical tests** hitherto unobtainable.
5. **Consistent quality.**
6. **Degasification,** giving good castability and soundness.
7. **Guaranteed analysis** to specification.

FOR MALLEABLE IRON CASTINGS

Grade.	T.C.	Si.	Mn.	P.	S.
M1 ..	2.8/3.0	1.0	0.3	0.1	0.08
M2 ..	2.8/3.0	0.8	0.3	0.1	0.08
M3 ..	2.8/3.0	0.6	0.3	0.1	0.08
M4 ..	2.6/2·8	1.0	0.3	0.1	0.08
M5 ..	2.6/2.8	0.8	0.3	0.1	0.08
M6 ..	2.6/2.8	0.6	0.3	0.1	0.08
M7 ..	2.6 max.	1.0	0.3	0.1	0.08
M8 ..	2.6 max.	0.8	0.3	0.1	0.08
M9 ..	2.6 max.	0.6	0.3	0.1	0.08

Several advantages for Armstrong Whitworth "New Process" malleable iron are given below :—

Advantages :

1. **Low carbon,** in complete solution during manufacture, with balanced silicon content, gives quicker annealing time.
2. **Iron on annealing shows extremely fine, well-disseminated, nodular graphite,** giving extremely tough malleable, with high resistance to shock.
3. **Low sulphur,** giving a better "malleable," particularly shown by high elongation on tensile test.
4. **Low sulphur** giving a less stable carbide, with saving in annealing.
5. **Less shrinkage** in finished castings owing to the range of analysis offering a correct control of carbon and silicon contents.
6. **Degasification,** giving good castability and soundness.
7. **Guaranteed analysis** to specification.

Telephone : *Gateshead 71181.*

ARMSTRONG CLOSE WORKS — SIR W. G. ARMSTRONG WHITWORTH & CO. (IRONFOUNDERS) LIMITED — WHITWORTH GATESHEAD ON TYNE

Telegraph : *Closework, Gateshead.*

This Week's News in Brief.

Trade Talk.

THE L.M.S. RAILWAY announce that during 1932 their normal programme of track-upkeep requires 74,000 tons of rails.

BRACKELSBERG MELTING PROCESSES, LIMITED, have removed from Malaya House, 57, Charing Cross, to Imperial Buildings, 56, Kingsway, London, W.C.2.

MESSRS. C. A. HILL & COMPANY have removed from 58 and 60, King Edward Street, Hull, to The Avenue, High Street, Hull. The new telephone number is 36614.

AN ORDER for large power-supply switchgear has been placed by the Copenhagen Lighting Department with Messrs. A. Reyrolle & Company, Limited, Hebburn-on-Tyne.

THE MOSTYN IRONWORKS at Mostyn, Flintshire, where work was suspended in 1930, owing to trade depression, were reopened last week, and the blast furnaces were again at work.

THE NEW FURNACE which the United Steel Companies, Limited, have built at Workington was put into blast last week. The furnace has a productive capacity of 3,000 tons per week.

THE CONTRACT for supplying the deck machinery for the sister ship of the "Monarch of Bermuda," which is being built at Barrow, has been secured by Messrs. Clarke, Chapman & Company, Limited, Gateshead.

THE SHIPBUILDING PLANT and machinery of the Northumberland Shipbuilding Company (1927), Limited, is to be offered for sale by auction on January 20 and 21 by Messrs. Fuller, Horsey, Sons & Cassell, of London.

AN ORDER FOR 1,200 tons of steelwork for L.N.E.R. bridges has been placed with Messrs. Dorman, Long & Company, Limited, Middlesbrough, by Sir Robert McAlpine & Sons, London, who are the contractors for the work.

MESSRS. VICKERS-ARMSTRONGS, LIMITED, have completed at Barrow the new P. and O. turbo-electric steamer "Strathaird." She is a sister ship of the "Strathnaver," built at Barrow for the same owners. They are of 22,547 tons.

MESSRS. BRAYSHAW FURNACES & TOOLS, LIMITED, Mulberry Street, Hulme, Manchester, have acquired a works in Boundry Street, Belle Vue, Manchester, to which they are transferring the whole of their plant for the construction of industrial furnaces, the new works being laid down to deal exclusively with this section of the company's activities.

THE TRANSFERENCE of the fuse-gear section of the English Electric Company, Limited, to Stafford will be completed by about the end of this month, and the firm's Ordnance Works at Coventry will then close down. The tool branch of the business formerly carried on at the Coventry factory has already been transferred to the company's Rugby works.

A LECTURE ON "Recent Developments in Cast Iron" was given by Mr. J. G. Pearce, director of the British Cast-Iron Research Association, at a meeting recently of the Sheffield Metallurgical Association. The lecture dealt with the lines along which the improvement of cast iron is being sought, and dealt with pre-war and post-war cast iron. Mr. G. Stanfield presided.

CONTRIBUTIONS TO charitable institutions have been made by employees of the following Scottish firms:—Glasgow Iron & Steel Company, Limited, £516; John Brown & Company, Limited, £1,820; Ramage & Ferguson, Limited, £76; Scottish Tube Company, Limited, £814; Bairds & Dalmellington, Limited, £6,525; William Baird & Company, Limited, £2,433; Stewarts & Lloyds, Limited, £3,430.

MESSRS. WALTER SCOTT, LIMITED, are restarting a blast furnace at their Leeds works. A second furnace is in course of preparation for blowing in. A representative of the firm stated that its blast-furnace plant had been closed down since July on account of accumulated stocks of pig-iron. These had now been reduced, and sufficient orders for foundry iron had been received from foundries in Yorkshire and Lancashire to warrant restarting part of the plant.

THE LONDON CHAMBER OF COMMERCE states that arrangements have been completed for the starting of several factories in London or Greater London by foreign firms. They include a factory for the manufacture of wringing machines, a factory for arms and ammunition, and a chemical factory. In addition there is to be a factory on Merseyside for the manufacture of batteries and electrical equipment for German interests, and, at Slough, a German factory to employ 2,000 persons in the making of electrical accessories and batteries. It is also reported that negotiations have been completed by which a German firm will shortly start a factory for the manufacture of cutlery in London.

A BUYING MOVEMENT in the North-West Coast hematite pig-iron trade that followed the suspension of the gold standard was responsible for an increase of 11d. per ton in the average price of pig-iron, and blast-furnacemen's wages, based on an average selling price of £3 3s. 9d. during November and December, rise by 1¼ per cent.

LACK OF ORDERS is given as the reason for the closing of the Friedrich Alfred Steel Foundry, belonging to the Krupp concern, at Essen. Altogether 4,250 workmen have been dismissed, but the company hopes to be able to reopen the works some time in February. According to a report from Cologne, the Krupp firm will close also its extensive iron and steel works at Rheinhausen, near Duisburg.

SIR WILLIAM LARKE, director of the National Federation of Iron and Steel Manufacturers, commenting in an interview on the trade figures for December, said they showed that, with the exception of 1918 and 1921, iron and steel exports last year were the lowest since 1868, even lower than in 1926. Imports were actually higher than in 1929, the record year for world production. Thus the undermining of the British iron and steel industry, if persisted in, must reduce its capacity for recovery to a level that would involve the question of its ultimate survival—that was unless the Government took immediate measures to protect the industry against present competition at prices 40 per cent. below the cost of production in the countries of origin.

Obituary.

MR. JAMES GAVIN, J.P., who for many years was connected with the Dalzell Steelworks, died last week. He took a keen interest in trade-union organisation, and latterly was appointed to the permanent staff of the Steel Trades Confederation.

SIR HENRY COWAN, chairman of Messrs. Parkinson & Cowan, Limited, died at his home in London on Monday, January 11, at the age of 69. Born in Edinburgh, he became associated with Messrs. Parkinson & W. & B. Cowan, formed in 1900 to take over the gas-meter factory in London established by Mr. W. C. Parkinson in 1862. The style was changed in 1929 to Parkinson & Cowan, Limited, and Sir Henry was at his death chairman of the company and its subsidiary companies in the manufacture of gas and electricity meters and stoves. Sir Henry was for many years a member of Parliament, retiring in May, 1929.

Contracts Open.

Liverpool, February 11.—Wrought-iron lamp standards and brackets, cast-iron lamp columns, and malleable cast-iron pitching irons, etc., for the Corporation. Tender forms CL (1) and CL (2). The City Lighting Engineer, 17, Highfield Street, Liverpool.

Wellington, Salop, February 8.—Supplying and laying of seven miles of 8-in. and one mile of 6-in., 4-in. and 3-in. dia. cast-iron pipes, for the Urban District Council. Mr. E. Sandeman, 15, Victoria Street, Westminster, S.W.1. (Fee £5, returnable.)

Jubilee of a Cast-iron Lighthouse.—Cape Henry Lighthouse, U.S.A., the tallest fully-enclosed cast-iron lighthouse in the States, has just celebrated the jubilee of its existence. It stands 150 ft. above the ground, and is now equipped with a powerful fog signal, radio beacon and synchronising apparatus for distance finding.

Personal.

MR. JAMES A. FARRELL is retiring from the Presidency of the United States Steel Corporation as from April 18 next. He will, however, continue to be a member of the directorate.

DR. ROBERT HAY, B.Sc., has been appointed to the Chair of Metallurgy in the Royal Technical College, Glasgow. Dr. Hay succeeds in the Chair Prof. J. H. Andrew, whose assistant he was for many years.

MR. E. RONCERAY, managing director of Messrs. Bonvillain & Ronceray, has been co-opted on the Council of the French Board of Technical Education as the representative of the headmasters of State-recognised technical schools.

MR. W. R. BARCLAY, O.B.E., who has been nominated as a Vice-President of the Institute of Metals, is an original member of the Institute, and has been a Member of Council since 1925. He is consulting metallurgist to the Mond Nickel Company, Limited.

SIR HENRY FOWLER, K.B.E., LL.D., D.Sc., who has been nominated as President of the Institute of Metals for 1932-33, was for many years chief mechanical engineer of the London Midland & Scottish Railway Company, and is now assistant to the vice-president (research and development) of the company.

MR. F. A. MELMOTH, assistant manager, Detroit Steel Castings Company, Detroit, U.S.A., who was previously connected with Thomas Firth & Sons, Limited, of Sheffield, and Lake & Elliot, Limited, of Braintree, has been selected by the American Foundrymen's Association to present a Paper on its behalf to the Bureau of Steel Manufacturers of Australia.

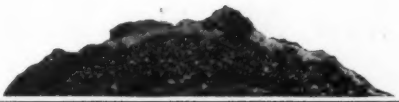
AT A COUNCIL MEETING of the Institute of British Foundrymen, held last Saturday, Mr. F. J. Cook, its oldest Past-President, a founder, and an Oliver Stubbs medallist, and Mr. John Shaw who has been President of both the Sheffield and Birmingham Branches, an Oliver Stubbs medallist and one of its most distinguished members, were elected honorary members of the Institute.

MR. L. W. SPRING, who has been selected by the American Foundrymen's Association to receive the John A. Penton Gold Medal Award for 1932, is chief chemist and metallurgist of the Crane Company, Chicago. A native of Coldwater, Michigan, Mr. Spring attended the University of Michigan, and was granted the degree of A.B. in Chemistry, after which he accepted a position as chemist with the Illinois Steel Company, South Chicago. Later he served for a year in a similar capacity with the Wolverine Portland Cement Company, after which he returned to the former company for metallurgical and superintendency work in the plate mill. In 1906 Mr. Spring became connected with Crane Company, serving first as chemist, being in charge of the laboratories till 1914, at which time he was advanced to the position of chief chemist and metallurgist. Mr. Spring is the author of the very interesting book "Non-Technical Chats on Iron and Steel." He has also written extensively for the technical Press and engineering associates, and was author of the 1931 American Exchange Paper for the Institute of British Foundrymen, the subject being "Considerations and Tests for Cast Materials for High-Temperature High-Pressure Service," along which lines Mr. Spring has done extensive research work. Mr. Spring holds membership in many technical associations and has rendered valuable service in technical committee activities. He is a member of the American Foundrymen's Association Committees on Cast Iron, Non-ferrous Metals and Malleable Iron, and represents the Association and the American Institute of Mining and Metallurgical Engineers on the Advisory Committee to the Bureau of Standards. He is also a member of several other organisations, such as the American Society for Steel Treating, American Chemical Society, Institute of Metals and the American Institute of Mining and Metallurgical Engineers.

Wills.

BURNS-LINDOW, S. L., of Cumberland, ironmaster £127,932

GRAHAM, FRANK, J.P., of Gosforth, retired iron and steel merchant, formerly representative of Messrs. John Brown & Company, Limited, Sheffield, and Messrs. Stewarts & Lloyds, Limited, Glasgow £47,191



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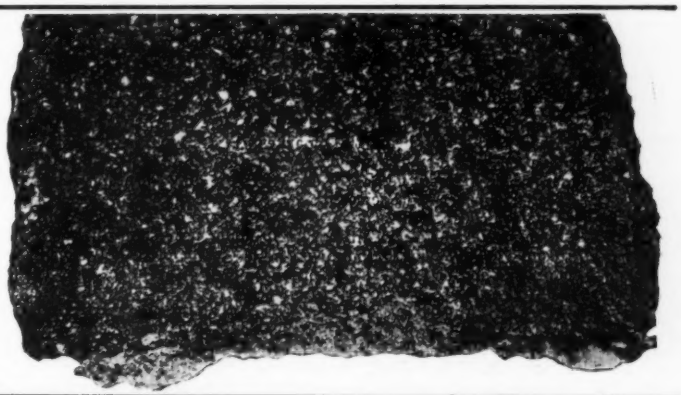

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THE SIGN

CUMMING'S CCC CORE COMPOUND

CUMMING'S CPP PARTING POWDER

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Raw Material Markets.

There is little new buying in the iron and steel markets, except for immediate delivery, but deliveries against current contracts are maintained at a satisfactory level. There has been a decrease in imports of Continental semis and finished steel, and the producers are less ready sellers than they have been. On the whole, home producers have confidence in the future, partly because of the increasing number of inquiries now being received and partly because they expect the Government to impose a tariff on imported iron and steel before very long.

Pig-Iron.

MIDDLESBROUGH.—The tone of the market has improved considerably during the past few days. Pig-iron shipments from the Tees are on the increase, and more inquiries are circulating on home account. Scottish consumers are now back to work, and deliveries of Cleveland iron to that area have been resumed. The local foundrymen's consumption remains limited. Messrs. Dorman, Long & Company, Limited, are to stop a furnace, at present on Cleveland iron, at the end of the month, but it is proposed to relight a hematite furnace in its stead, so that the total number of furnaces in blast on the North-East Coast will remain at 17.

The East Coast hematite market remains quiet, but steady, makers still having large stocks of unsold iron to dispose of. A furnace is shortly to be restarted on hematite, the owners requiring most of the output for their own needs. A good volume of inquiries is circulating in the West Coast hematite market, and makers have more confidence in the future. Practically the whole of the present output is being sold. The new furnace at Derwent was put into operation last week. Bessemer mixed numbers remain at 66s. per ton at works.

LANCASHIRE.—Few new orders for pig-iron have been received, but consumers are taking very satisfactory deliveries against current contracts. The textile-machinery makers are slightly better placed. Prices remain unchanged, with Midland foundry makes on offer for delivery to users in the Manchester price zone at 67s. per ton, North-East Coast at 67s., Northamptonshire at 65s. 6d., Derbyshire forge iron at 62s., Scottish pig-iron at about 87s. and West Coast hematite at 81s.

MIDLANDS.—The market has shown no new developments, most consumers being already covered well forward. Some small orders have been received from the light-castings foundries, but the heavy engineering trades are short of work. For delivery to Birmingham and Black Country stations, makers quote 62s. 6d. for Northants No. 3 and 66s. for Derbyshire, North Staffordshire and Lincolnshire No. 3.

SCOTLAND.—Most of the steelworks and foundries have now resumed operations, but the new orders for pig-iron so far given are only of small dimensions. Practically no Continental iron is being imported, but 2,250 tons of Indian iron was landed in the Clyde last week. Prices remain unchanged.

Coke.

The coke market in the Midlands remains quiet, and little forward buying is reported. Best Durham grades are at 37s. 6d. to 39s. per ton, delivered Birmingham, with secondary fuel at 35s., while quotations for Welsh coke vary from 30s. to 45s., according to grade. The price of good Durham furnace coke at works is firm at 17s. per ton.

Steel.

The British producers of semi-finished steel are now receiving a larger proportion of the orders going, owing to the difficulties of negotiating for foreign supplies, and to the fact that Continental producers are not pressing their sales, in view of their reduced output and the proposals for a selling syndicate. The total volume of business passing, however, is not very large. The finished-steel market remains dull, with no sign of any early improvement.

Scrap.

The Cleveland scrap-iron and steel market remains in a strong position, supplies being well taken up. The general sellers' quotation for heavy steel is still 42s. 6d. per ton. The foundries are paying 45s. for ordinary heavy cast iron. In the Midlands market there is a good demand for all qualities of cast-iron scrap and prices are firm at 52s. 6d. delivered for machinery metal broken into handy sizes, 47s. 6d. to 50s. for good heavy metal and 40s. for light metal. The South Wales market is slow, most consumers being already covered. There has been no change in the Scottish market.

Metals.

Copper.—Interest in copper last week was centred on the rise in American prices. It is the general opinion in this country that the increase was not justified by any sharpening of the demand, and was made solely on sentimental grounds. Full details of the proposed sales regulations are not yet available, but it is believed that full provision will be made for the Customs smelters, thus relieving the market of any selling pressure by the latter. In the meantime, there is little demand to report from consumers on either side of the Atlantic.

Closing quotations :—

Cash.—Thursday, £41 5s. to £41 6s. 3d.; Friday, £40 15s. to £40 16s. 3d.; Monday, £39 15s. to £39 16s. 3d.; Tuesday, £39 5s. to £39 7s. 6d.; Wednesday, £39 15s. to £39 17s. 6d.

Three Months.—Thursday, £41 5s. to £41 6s. 3d.; Friday, £40 15s. to £40 16s. 3d.; Monday, £39 15s. to £39 16s. 3d.; Tuesday, £39 7s. 6d. to £39 10s.; Wednesday, £39 15s. to £39 17s. 6d.

Tin.—The demand for tin in America remains poor, but some support is evident in this country, where the tinplate industry continues in a better condition. Messrs. W. J. Carter & Company say that the tin statistics for January "are expected to show a further moderate increase in the visible supplies, but the market receives constant support and reactions are quickly recovered."

Official closing prices :—

Cash.—Thursday, £141 to £141 2s. 6d.; Friday, £141 15s. to £141 17s. 6d.; Monday, £140 10s. to £140 12s. 6d.; Tuesday, £140 15s. to £140 17s. 6d.; Wednesday, £141 10s. to £141 12s. 6d.

Three Months. — Thursday, £144 5s. to £144 7s. 6d.; Friday, £144 17s. 6d. to £145; Monday, £143 12s. 6d. to £143 15s.; Tuesday, £143 15s. to £143 17s. 6d.; Wednesday, £144 10s. to £144 12s. 6d.

Spelter.—There is no improvement in the demand from consumers either here or on the Continent, but the market shows no weakness, sellers being aware that a gradual reduction of consumers' stocks is being effected. Should there be any fresh increase in demand, the price would immediately respond.

Daily fluctuations :—

Ordinary.—Thursday, £14 11s. 3d.; Friday, £14 13s. 9d.; Monday, £14 8s. 9d.; Tuesday, £14 5s.; Wednesday, £14 10s.

Lead.—There is little demand from consumers in evidence, but the metal remains under firm control. Quotations rose last week, in sympathy with the other metals, but subsequently dropped on the recovery in sterling. The general situation remains unaltered.

The week's prices have been :—

Soft Foreign (Prompt).—Thursday, £15 6s. 3d.; Friday, £15 6s. 3d.; Monday, £15 3s. 9d.; Tuesday, £14 18s. 9d.; Wednesday, £15 1s. 3d.

Beryl, etc., in India.—It appears from the quarterly report of Mr. H. A. F. Lindsay, Indian Trade Commissioner in London, that during the period July to September a certain amount of interest was shown to the possibility of obtaining supplies of beryl from India and of monazite as a source of meso-thorium to use in place of radium. Anxiety has been expressed regarding the future supplies of ilmenite which is now extensively used, particularly in the United States as the source of white pigment. This has now been set at rest as Travancore (India) has very large reserves.

Book Review.

Early Forges and Furnaces in New Jersey, by CHARLES S. BOYER. Published by the Oxford University Press, Warwick Square, London, E.C.4. Price 28s. net.

This book reminds us very strongly of one we recently reviewed dealing with the Wealden iron industry, but it starts just about where the latter finishes. It might be thought that, dealing with an American historical development, it would have but little interest for British readers. Actually, the contrary is the case, as constant references are made to the "Old Country." Most of the names are as English as the Tower of London—Ringwood, Birmingham, Sussex, Coventry, Dover, Windsor, Manchester, Durham, Andover, Burlington, all bespeak of the recent relationships with English industry. Moreover a number of mortgages were from time to time effected with English residents. There is one great difference between the Wealden iron industry and that of New Jersey. As far as one can estimate, the former was carried on by highly-paid operatives, the latter was operated in its early days by black-slave labour.

The book is particularly well printed and excellently illustrated, whilst the bibliography and index are a credit to the author's painstaking care.

Institute of Metals.

(*Concluded from page* 56.)

ing," by O. F. Hudson, D.Sc., and J. McKeown, Ph.D.

"Observations on the Pressure of Fluidity of Annealed Metals," by H. O'Neill, D.Sc., M.Met., and H. Greenwood, B.Sc.

"The Solubility of Aluminium in Magnesium in the Solid State at Different Temperatures," by Prof. P. Saldau and M. Zamotorin.

"Note on the Interaction of Aluminium and Water Vapour," by Richard Seligman, Ph.nat.D., and P. Williams, B.Sc.

"The Intercrystalline Corrosion of Duralumin," by A. J. Sidery, K. G. Lewis, M.Sc., and H. Sutton, M.Sc.

"The Properties of Copper in Relation to Low Stresses (the Effect of Cold-Work, Heat-Treatment and Composition). Part II.—Creep Tests at 300 deg. C. and 350 deg. C., of Arsenical Copper and Silver-Arsenical Copper," by H. J. Tapsell, A.C.G.I., and A. E. Johnson, M.Sc.

"The 'Fogging' of Nickel," by W. H. J. Vernon, D.Sc., Ph.D.

May Lecture.

The annual May lecture will be delivered in London on Wednesday, May 11, by Prof. Dr. Friedrich Körber, Director of the Kaiser-Wilhelm-Institut für Eisenforschung, Düsseldorf, on the subject of the plastic deformation of metals.

Notes from I.B.F. Branches.

Burnley Section.—Mr. W. C. Devereux was the lecturer at the last meeting of the Section held on January 14. He repeated his lecture on "High Strength Light Alloys," which has already been printed in our columns. The Section has organised a social evening to be held on Saturday, January 23, at Greenwood's Rooms.

Iron and Steel Institute.—The Council of the Iron and Steel Institute regrets to announce that, owing to the prevailing conditions, particularly the unfavourable rate of exchange, it has been decided to postpone the meeting which, by kind invitation of the American Iron and Steel Institute and the American Institute of Mining and Metallurgical Engineers, was to have been held in the United States in September, 1932. The alternative arrangements to be made for the autumn meeting this year will be announced as soon as possible.

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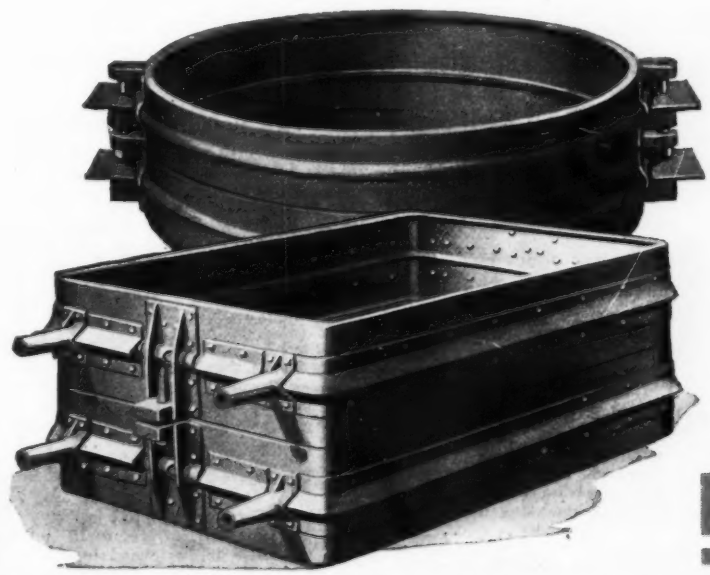
We invite you to prove this statement by allowing us to demonstrate to you how Sterling Boxes can save you money. There are some thirty standard types to meet almost every foundry need. For special purposes our technical staff will gladly design for you the most economical box for your job.



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WEEKLY PRICE CURRENT.

COPPER.

	£ s. d.
Standard cash	39 15 0
Three months	39 15 0
Electrolytic	46 10 0
Tough	41 5 0
Best selected	41 10 0
Sheets	77 0 0
India	54 10 0
Wire bars	49 10 0
Do., February	48 10 0
Do., March	47 10 0
Ingot bars	49 10 0
H.C. wire rods	49 10 0
Off. av. cash, Dec.	38 6 5 6/11
Do., 3 mths., Dec.	38 19 1 17/22
Do., Sttlmnt., Dec.	38 6 3
Do., Electro, Dec.	45 14 1 1/11
Do., B.S., Dec.	40 6 9
Do., wire bars, Dec.	46 19 1 1/11
Solid drawn tubes	11½d.
Brazed tubes	11½d.
Wire	7½d.

BRASS.

Solid drawn tubes	10d.
Brazed tubes	12d.
Rods, drawn	9d.
Rods, extd. or rlld.	5½d.
Sheets to 10 w.g.	8½d.
Wire	8½d.
Rolled metal	8d.
Yellow metal rods	5½d.
Do. 4 × 4 Squares	6½d.
Do. 4 × 3 Sheets	6½d.

TIN.

	£ s. d.
Standard cash	141 10 0
Three months	144 10 0
English	143 5 0
Bars	144 5 0
Straits	143 10 0
Australian	142 0 0
Eastern	146 15 0
Banca	160 15 0
Off. av. cash, Dec.	138 19 7 5/13
Do., 3 mths., Dec.	141 19 3 9/11
Do., Sttlmt., Dec.	138 19 6 9/11

SPELTER.

	£ s. d.
Ordinary	14 10 0
Remelted	13 7 6
Hard	11 0 0
Electro 99.9	16 10 0
English	15 0 0
India	13 5 0
Zinc dust	23 0 0
Zinc ashes	4 0 0
Off. aver., Dec.	14 11 9 21/44
Aver. spot, Dec.	14 7 2 15/22

LEAD.

	£ s. d.
Soft foreign ppt.	15 1 3
English	16 10 0
Off. average, Dec.	15 5 5 5/13
Average spot, Dec.	15 3 9

ZINC SHEETS, &c.

	£ s. d.
Zinc sheets, English	24 10 0
Do., V.M. ex-whf.	27 0 0
Rods	32 0 0
Boiler plates	—
Battery plates	—

ANTIMONY.

	£ s. d.
Special brand, Eng.	40 0 0
Chinese	28 0 0
Crude	22 0 0

QUICKSILVER.

	£ s. d.
Quicksilver	17 15 0

FERRO-ALLOYS AND STEEL-MAKING METALS.

Ferro-silicon—	
25%	6 15 0
45/50%	9 15 0
75%	15 17 6
Ferro-vanadium—	
35/60%	12/8 lb. Va.
Ferro-molybdenum—	
70/75% c. free, 4/2, plus 55% per lb. Mo.	
Ferro-titanium—	
23/25% carbon-free	11½d. lb.
Ferro-phosphorus, 20/25%	£21 17 6
Ferro-tungsten—	
80/85%	1/8½ lb. plus 20%
Tungsten metal powder—	
98/99%	1/11½ lb. plus 20%
Ferro-chrome—	
2/4% car.	£34 0 0
4/6% car.	£24 12 6
6/8% car.	£23 10 0
8/10% car.	£22 17 6
Ferro-chrome—	
Max. 2% car.	£36 10 0
Max. 1% car.	£43 17 6
Max. 0.70% car.	£52 12 6
70%, carbon-free	11d. lb.
Nickel—99%	£240 to £245
Ferro-cobalt	8/6 lb.
Aluminium 98/99%	£95 0 0
Metallic chromium—	
96/98%	2/9 lb.
Ferro-manganese (net)—	
76/80% loose	£10 15 0 to £11 5 0
76/80% packed	£11 15 0 to £12 5 0
76/80% export	(nom.) £ 9 0 0
Metallic manganese—	
94/96% carbon-free	1/6 lb.

Per ton unless otherwise stated.

HIGH-SPEED TOOL STEEL.

Finished bars, 14% tungsten	2s. 0d.
Finished bars, 18% tungsten	2s. 9d.

Per lb. net, d/d buyers' works.

Extras—

Rounds and squares, 3 in. and over	4d. lb.
Rounds and squares, under ½ in. to ¼ in.	3d. lb.
Do., under ¼ in. to 7/16 in.	1/- lb.
Flats, ½ in. × ¼ in. to under 1 in. × ¼ in.	3d. lb.
Do., under ½ in. × ¼ in.	1/- lb.
Bevels of approved sizes and sections	6d. lb.

Bars cut to length, 10% extra.

SCRAP.

	£ s. d.	£ s. d.
South Wales—		
Heavy steel	2 6 0	to 2 7 6
Bundled steel and shrngs.	1 16 6	to 1 18 0
Mixed iron and steel	2 0 0	to 2 2 0
Heavy cast iron		2 7 0
Good machinery for foundries	2 12 0	to 2 14 0
Cleveland—		
Heavy steel	2 0 0	to 2 2 6
Steel turnings		1 12 6
Cast-iron borings		1 6 0
Heavy forge		3 0 0
W.I. piling scrap		2 12 6
Cast-iron scrap	2 5 0	to 2 7 6
Midlands—		
Light cast-iron scrap		2 0 0
Heavy wrought iron		2 15 0
Steel turnings, f.o.r.		1 3 0
Scotland—		
Heavy steel		2 2 6
Ordinary cast iron		2 8 6
Engineers' turnings		1 11 6
Cast-iron borings		1 12 0
Wrought-iron piling		2 7 6
Heavy machinery		2 15 0

London—Merchants' buying prices delivered yard.

	£ s. d.
Copper (clean)	30 0 0
Brass	22 0 0
Lead (less usual draft)	12 10 0
Tea lead	9 10 0
Zinc	7 0 0
New aluminium cuttings	62 0 0
Braziery copper	27 0 0
Gunmetal	26 0 0
Hollow pewter	90 0 0
Shaped black pewter	70 0 0

PIG-IRON.

(f.o.t. unless otherwise stated.)

N.E. Coast—	
Foundry No. 1	61/-
Foundry No. 3	58/6
Foundry No. 4	57/6
Forge No. 4	57/-
Hematite No. 1	65/6
Hematite M/Nos.	65/-
N.W. Coast—	
Hem. M/Nos. d/d Glas.	73/-
„ d/d Birm.	84/6
Malleable iron d/d Birm.	117/6
Midlands—	
Staffs common*	—
„ No. 4 forge*	61/-
„ No. 3 fdry.*	66/-
Shrops basic	—
„ Cold blast, ord.	—
„ „ roll iron	—
Northants forge*	57/6
„ fdry. No. 3*	62/6
„ fdry. No. 1*	65/6
Derbyshire forge*	61/-
„ fdry. No. 3*	66/-
„ fdry. No. 1*	69/-
„ basic*	—
Scotland—	
Foundry No. 1	72/-
„ No. 3	69/6
Hem. M/Nos. d/d	68/6
Sheffield (d/d district)—	
Derby forge	58/6
„ fdry. No. 3	63/6
Lincs forge	—
„ fdry. No. 3	63/6
E.C. hematite	76/-
W.C. hematite	83/6
Lancashire (d/d eq. Man.)—	
Derby forge	62/-
„ fdry. No. 3	67/-
Staffs fdry. No. 3	67/-
Northants fdry. No. 3	65/6
Cleveland fdry. No. 3	67/-
Dalzell, No. 3 (special)	102/6 to 105/-
Glengarnock, No. 3	87/-
Clyde, No. 3	87/-
Monkland, No. 3	87/-
Summerlee, No. 3	87/-
Eglinton, No. 3	87/-
Gartsherrie, No. 3	87/-
Shotts, No. 3	87/-

*d/d Black Country dist.

FINISHED IRON AND STEEL.

Usual District deliveries for iron; delivered consumers' station for steel.

	£ s. d.	£ s. d.
Iron—		
Bars (cr.)	9 15 0	to 10 0 0
Nut and bolt iron	8 7 6	to 8 10 0
Hoops	10 10 0	to 12 0 0
Marked bars (Staffs) f.o.t.		12 0 0
Gas strip	10 10 0	to 12 0 0
Bolts and nuts, ¾ in. × 4 in.		12 5 0
Steel—		
Plates, ship, etc.	8 15 0	to 8 17 6
Boiler plts.	8 15 0	to 9 15 0
Chequer plts.		10 7 6
Angles		8 7 6
Tees		9 7 6
Joists		8 15 0
Rounds and squares, 3 in. to 5½ in.		9 7 6
Rounds under 3 in. to ¾ in. (Untested)	6 15 0	& up.
Flats—8 in. wide and over		8 12 6
„ under 8 in. and over 5 in.		8 17 6
Rails, heavy	8 5 0	to 8 10 0
Fishplates		12 0 0
Hoops (Staffs)		9 10 0
Black sheets, 24g.	8 0 0	to 9 0 0
Galv. cor. shts.	9 0 0	to 9 5 0
Galv. flat sheets	9 10 0	to 9 15 0
Galv. fencing wire, 8g. plain		12 10 0
Billets, soft	5 7 6	to 5 12 6
Billets, hard		6 12 6
Sheet bars	5 0 0	to 5 5 0
Tin bars		5 0 0

PHOSPHOR BRONZE.

	Per lb. basis.
Strip	11¾d.
Sheet to 10 w.g.	12¾d.
Wire	13¾d.
Rods	11¾d.
Tubes	17d.
Castings	13d.

Delivery 3 cwt. free.
10% phos. cop. £30 above B.S.
15% phos. cop. £35 above B.S.
Phosphor tin (5%) £30 above price of English ingots.
C. CLIFFORD & SON, LIMITED.

NICKEL SILVER, &c.

	Per lb.
Ingots for raising	7d. to 1/1
Rolled—	
To 9 in. wide	1/1 to 1/7
To 12 in. wide	1/1½ to 1/7½
To 15 in. wide	1/1½ to 1/7½
To 18 in. wide	1/2 to 1/8
To 21 in. wide	1/2½ to 1/8½
To 25 in. wide	1/3 to 1/9
Ingots for spoons and forks	7d. to 1/3½
Ingots rolled to spoon size	10d. to 1/6½
Wire round—	
to 10g.	1/4½ to 1/11½

with extras according to gauge.
Special 5ths quality turning rods in straight lengths, 1/3½ upwards.

AMERICAN IRON AND STEEL.

At Pittsburgh unless otherwise stated.

	Dols.
No. 2 foundry, Phila.	15.64
No. 2 foundry, Valley	15.50
No. 2 foundry, Birm.	12.00
Basic	16.89
Bessemer	17.89
Malleable	17.89
Grey forge	17.44
Ferro-mang. 80%	75.00
O.-h. rails, h'y, at mill	43.00
Billets	28.00
Sheet bars	28.00
Wire rods	37.00
	Cents.
Iron bars, Phila.	2.11
Steel bars	1.50
Tank plates	1.50
Beams, etc.	1.50
Skelp, grooved steel	1.50
Skelp, sheared steel	1.50
Steel hoops	1.65
Sheets, black, No. 24	2.25
Sheets, galv., No. 24	2.80
Wire nails	1.95
Plain wire	2.20
Barbed wire, galv.	2.60
Tinplates, 100-lb. box	$4.75

COKE (at ovens).

Welsh foundry	22/6 to 25/-
„ furnace	17/6 to 18/-
Durham and Northumberland—	
„ foundry	14/6 to 15/-
„ furnace	14/6
Midlands, foundry	—
„ furnace	—

TINPLATES.

f.o.b. Bristol Channel ports.

I.C. cokes 20×14 per box	14/- to 14/9
„ 28×20 „	28/- to 29/6
„ 20×10 „	—
„ 18¾×14 „	—
C.W. 20×14 „	12/9 to 13/-
„ 28×20 „	25/3
„ 20×10 „	19/4½
„ 18¾×14 „	13/9

SWEDISH CHARCOAL IRON & STEEL.

Pig-iron	£6 0 0 to £7 0 0
Bars, hammered, basis	£16 10 0 to £17 0 0
Bars and nail-rods, rolled, basis	£15 17 6 to £16 5 0
Blooms	£10 0 0 to £12 0 0
Keg steel	£32 0 0 to £33 0 0
Faggot steel	£18 0 0 to £23 0 0
Bars and rods dead soft, st'l	£10 0 0 to £12 0 0

All per English ton, f.o.b. Gothenburg.
[Subject to an exchange basis of Kr. 18.16 to £1.]

TUBES AND FITTINGS.

Current Discounts.

	Tubes.	*Fittings.*
Gas	62½%	57½%
Water ..	58½%	52½%
Steam ..	55%	47½%

W.I. 12½% extra.

DAILY FLUCTUATIONS.

Standard Copper (cash).

			£	s.	d.	
Jan.	14	..	41	5	0 dec.	17/6
,,	15	..	40	15	0 ,,	5/–
,,	18	..	39	15	0 ,,	20/–
,,	19	..	39	5	0 ,,	10/–
,,	20	..	39	15	0 inc.	10/–

Electrolytic Copper.

			£	s.	d.	
Jan.	14	..	47	0	0 dec.	30/–
,,	15	..	47	0	0 No change	
,,	18	..	46	10	0 dec.	10/–
,,	19	..	46	10	0 No change	
,,	20	..	46	10	0 ,, ,,	

Standard Tin (cash).

			£	s.	d.	
Jan.	14	..	141	0	0 dec.	22/6
,,	15	..	141	15	0 inc.	15/–
,,	18	..	140	10	0 dec.	25/–
,,	19	..	140	15	0 inc.	5/–
,,	20	..	141	10	0 ,,	15/–

Tin (English ingots).

			£	s.	d.	
Jan.	14	..	142	10	0 dec.	30/–
,,	15	..	143	5	0 inc.	15/–
,,	18	..	142	0	0 dec.	25/–
,,	19	..	142	5	0 inc.	5/–
,,	20	..	143	5	0 ,,	20/–

Zinc Sheets (English).

			£	s.	d.	
Jan.	14	..	24	10	0 No change	
,,	15	..	24	10	0 ,, ,,	
,,	18	..	24	10	0 ,, ,,	
,,	19	..	24	10	0 ,, ,,	
,,	20	..	24	10	0 ,, ,,	

Spelter (ordinary).

			£	s.	d.	
Jan.	14	..	14	11	3 No change	
,,	15	..	14	13	9 inc.	2/6
,,	18	..	14	8	9 dec.	5/–
,,	19	..	14	5	0 ,,	3/9
,,	20	..	14	10	0 inc.	5/–

Lead (English).

			£	s.	d.	
Jan.	14	..	16	15	0 dec.	5/–
,,	15	..	16	15	0 No change	
,,	18	..	16	10	0 dec.	5/–
,,	19	..	16	5	0 ,,	5/–
,,	20	..	16	10	0 inc.	5/–

AVERAGE MONTHLY PRICES OF STEEL RAILS.

Year.	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Yearly average.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
1916	10 19 4	11 0 0	11 0 0	10 18 9	10 17 6	10 17 6	10 17 6	10 17 6	10 17 6	10 17 6	10 17 6	10 17 6	10 9 10
1917	10 17 6	10 17 6	10 17 6	10 17 6	10 17 6	10 17 6	10 17 6	10 17 6	10 17 6	10 17 6	10 17 6	10 17 6	10 17 6
1918	10 17 6	10 17 6	10 17 6	10 17 6	10 17 6	10 17 6	10 17 6	10 17 6	10 17 6	10 17 6	10 17 6	10 17 6	10 17 6
1919	10 17 6	13 7 6	13 7 6	13 7 6	15 0 0	15 10 0	16 0 0	16 10 0	16 10 0	16 10 0	16 10 0	17 5 0	14 12 11
1920	18 15 0	19 5 0	20 7 6	22 0 0	23 0 0	23 0 0	24 0 0	25 0 0	25 0 0	25 0 0	25 0 0	25 0 0	22 18 11½
1921	23 5 0	20 4 0	18 0 0	17 0 0	15 0 0	15 0 0	14 0 0	14 0 0	14 0 0	11 12 6	10 10 0	10 0 0	15 4 3
1922	9 10 0	9 10 0	9 10 0	9 10 0	9 10 0	9 10 0	9 10 0	9 0 0	8 15 0	8 15 0	8 15 0	8 15 0	9 4 2
1923	8 17 6	9 2 0	10 5 0	10 10 0	10 10 0	10 10 0	9 15 0	9 0 0	8 15 0	8 15 0	8 19 0	9 5 0	9 9 10
1924	9 5 0	9 5 0	9 5 0	9 5 0	9 5 0	9 2 6	9 0 0	9 0 0	9 0 0	9 0 0	9 0 0	9 0 0	9 2 3½
1925	9 0 0	9 0 0	9 0 0	9 0 0	8 15 0	8 10 7½	8 10 0	8 10 0	8 10 0	8 4 0	8 0 0	8 0 0	8 11 7½
1926	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 7 6	8 10 0	8 10 0	8 10 0	8 10 0	8 3 11½
1927	8 10 0	8 10 0	8 10 0	8 2 6	8 2 6	8 2 6	8 2 6	8 2 6	8 2 6	8 3 0	8 5 0	8 5 0	8 4 10
1928	8 5 0	8 5 0	8 5 0	8 5 9	8 6 3	8 6 3	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 7 9½
1929	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0
1930	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0
1931	8 9 6	8 7 6	8 7 6	8 7 6	8 7 6	8 7 6	8 7 6	8 7 6	8 7 6	8 7 6	8 7 6	8 7 6	8 7 8

AVERAGE MONTHLY PRICES OF BLACK SHEETS, 24 GAUGE.

Year.	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Yearly average.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
1913	9 0 0	9 0 0	9 0 0	9 0 0	9 0 0	9 0 0	9 0 0	8 15 6	8 12 6	8 11 0	8 10 0	8 10 0	8 16 7
1923	11 17 6	13 2 6	13 15 0	14 11 10½	14 12 6	14 1 0	13 10 0	13 12 0	13 15 0	13 17 6	14 0 0	14 0 0	13 14 6½
1924	13 19 4½	13 14 6	13 12 6	13 12 6	12 17 6	13 1 3	13 5 0	13 4 0	13 2 6	12 19 0	12 10 7½	12 12 6	13 4 3½
1925	12 12 6	12 6 10½	11 18 9	11 15 0	11 15 0	11 12 0	11 10 0	11 6 3	11 5 0	11 5 0	11 5 0	11 5 0	11 13 10½
1926	11 5 0	11 5 0	11 5 0	11 4 0	10 17 6	10 17 6	11 0 6	11 3 9	11 5 7½	11 13 6	12 5 0	12 12 6	11 7 10½
1927	12 8 9	11 14 4½	11 4 4½	11 7 6	11 7 6	11 7 6	10 13 6	10 7 6	10 7 6	10 7 6	10 7 6	10 2 6	10 19 11½
1928	10 2 6	9 16 10½	10 2 6	9 18 9	9 15 0	9 19 6	9 19 4½	10 0 0	10 0 0	10 0 0	10 0 0	10 0 0	9 19 6½
1929	10 0 0	10 0 0	10 0 0	10 0 0	10 8 0	10 7 6	10 5 0	10 5 0	10 5 0	10 6 6	10 3 9	9 18 9	10 3 3½
1930	9 16 0	9 15 0	9 15 0	9 15 0	9 5 0	9 15 0	9 13 0	9 12 6	9 12 6	9 4 0	9 4 4½	9 2 6	9 10 0
1931	9 2 0	9 0 0	9 0 0	9 0 0	9 0 0	8 15 0	8 15 0	8 6 3	7 18 9	8 13 6	8 15 0	8 11 0	8 14 8½

WILLIAM JACKS & COMPANY,

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REGISTERED TRADE MARK

All grades FOUNDRY, HEMATITE, BASIC, SPECIALS, &c.

NON-FERROUS METALS

COPPER, TIN, LEAD, SPELTER, ANTIMONY, CHROME ORE.

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19, ST. VINCENT PLACE, GLASGOW.

ZETLAND ROAD, MIDDLESBROUGH.

SMALL ADVERTISEMENTS.

Notice.

Small Advertisements in this section of the Journal are accepted at the prepaid rate of 6d. per line, first line in capitals counting two, average 6 words per line. Minimum charge for one insertion 3/-

(A remittance should accompany instructions.)

SITUATIONS WANTED.

FOUNDRY MANAGER (non-ferrous), with first-class references, open to re-engagement; exceptional experience bench, floor, machine moulding, etc.; best results at lowest costs.—Box 982, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

METALLURGIST, with wide experience in the manufacture of non-ferrous metals, foundry and rolling-mill practice, desires post as Works Manager.—Box 980, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

WANTED, Pig-iron Salesman; live wire; one accustomed to get round the trade. State salary and experience.—Box 978, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

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Any Member, Associate Member or Associate of the Institute of British Foundrymen who desires his qualifications to be inserted in the column must forward to the General Secretary of the Institute the following information:—(a) Name and address; (b) name of present employer (or last employer if unemployed); (c) brief particulars of qualifications, experience, and type of position required. The name will not be disclosed until the candidate is in communication with a prospective employer. Announcements will be inserted in two successive issues, unless announcers' requirements have been met with in the meantime.

Any employer wishing to communicate with a candidate should write to the General Secretary, quoting identification number.

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Correspondence should be addressed to the General Secretary, Institute of British Foundrymen, St. John Street Chambers, Deansgate, Manchester.

YOUNG Foundry Foreman requires re-engagement in similar capacity or as Foundry Manager; 4 years present position. Foreman, general foundry. Green, dry and loam. Technically trained. (159)

PARTNERSHIP.

A DIRECTORSHIP is vacant in small high-class iron foundry, also doing non-ferrous metals; only those with practical experience either in management or salesmanship considered.—Reply, Box 976, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

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PROTECT YOUR IDEAS.—Free, "Advice Handbook" on patenting inventions and registering trade marks by Registered Agent with 45 years' experience.—KINGS PATENT AGENCY, LIMITED, 146A, Queen Victoria Street, E.C.4.

PROPERTY.

MAGNIFICENT

11 ACRES WORKS SITE.

SHEFFIELD.

145,000 Sq. Ft. of Shops.

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with L.M. & S. and L. & N.E. Rlys.

WELL-BUILT & COMMODIOUS OFFICES

Will Sell whole or in lots to suit customers or Let on favourable terms. Unique opportunity for Manufacturers.

Apply—

THOS. W. WARD, LTD.,
ALBION WORKS, SHEFFIELD.

BRISTOL.

TO Engineers, Founders, Manufacturers.—Fine site of nearly three acres on arterial road, with Foundry and Workshops and own Rail Sidings into the premises. Modern Offices, Warehouses and Workrooms. Central Heating.—CHARLES A. TRICKS & SON, Auctioneers, St. Nicholas Street, Bristol.

PUBLICATION.

RYLAND'S DIRECTORY of the Coal, Iron, Steel, Tinplate, Metal, Engineering, Hardware and Allied Trades. 1932 edition. Ready shortly. Price 42s., bound in cloth.—INDUSTRIAL NEWSPAPERS, LTD., 49, Wellington Street, Strand, London, W.C.2.

MACHINERY.

BONVILLAIN & RONCERAY Universal Roll-over MOULDING MACHINE, hydraulic squeeze, type R.C.1, complete with Down Sand Frame Equipment.
Maximum available height under ram, 3 ft. 6 in.
Dimensions of table, 4 ft. 11 in. x 3 ft. 10½ in.
Distance between columns, 3 ft. 10½ in.
Stroke of ramming piston, 1 ft. 4⅛ in.
Pressure required for operation, 750 lbs. per sq. in.

The machine is complete with vertical type accumulator complete with all necessary valves, couplings, piping, etc., to make a self-contained unit of plant. The complete plant is in excellent condition and has been very little used. It was installed in 1927 and cost, ex maker's works and exclusive of installation expenses, £963.

OFFERS ARE INVITED.

"Adaptable" MOULDING MACHINE, No. 1802, to take 17 x 15 boxes. £20.

"Denby" JOLT MOULDING MACHINE, hand-operated, 24-in. square plate. £25.

One CUPOLA, 19 ft. high x 2 ft. 6 in. dia., to deliver 3 tons of metal per hr., complete with 90 new furnace bricks, and complete with "Cyclone" fan. £50.

"Adaptable" Portable Electric RIDDLE, 18½ in. dia., with ½-h.p. motor, 220 volts D.C. £12 10s.

Several Geared LADLES, 30-cwt., 20-cwt. and 8-cwt. capacity. Offers invited.

Portable Beam Type PLATFORM SCALE, to weigh up to 2½ cwts. Offers invited.

MUIR-HILL,
ELSINORE ROAD, OLD TRAFFORD, MANCHESTER.

THOS. W. WARD, LTD.

Portable Pumping Sets, comprising 2½-h.p. Oil Engine and Contractor's Diaphragm Pump, capacity 6,000 galls. per hr.

100 cub. ft. Portable Petrol-engine-driven Air Compressor Plant.

100-b.h.p. Horizontal Single-Cylinder Crude Oil Engine.

20-ton STEAM BREAKDOWN CRANE (L.N.W.R.), 25-ft. swan-neck jib; 4-ft. 8½-in. gauge; runner for jib.

New VERTICAL CROSS-TUBE BOILER, 7 ft. 6 in. x 3 ft. 3 in. dia., 100 lbs. pressure.

(ASK FOR "ALBION" MACHINERY CATALOGUE.)

ALBION WORKS, SHEFFIELD.

MACHINERY—*Continued.*

FOR SALE, as new, cheap. Tilghman's Sand Blast Plant. Type V.I. Complete, suitable for ordinary requirements. Vertical Tilghman's Compressor, Air Receiver and Exhausting Fan and Accessories.—OUZLEDALE FOUNDRY COMPANY, Barnoldswick.

SAND MIXERS.—New and Secondhand. Ask us to quote.—W. BREALEY & COMPANY, LIMITED, Station Works, Ecclesfield, Sheffield.

SALE, Foundry Cupola, 3 ft. 6 in. dia., air belt new, receiver, pillars. What offers, delivered?—Box 974, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

MISCELLANEOUS.

CUT DOWN COSTS 25 per cent. by using S.M. Patent Heating Coke; graded to meet all requirements.—Inquiries to STANDARD MINERALS COMPANY, Dept. 11, Bilbie Street, Nottingham.

WAX CORE VENTS, British make, all sizes, executed from stock. Also Foundry Plumbago, various grades. — WILLIAM OLSEN, LIMITED, Cogan Street, Hull.

250 TONS of good Cast Scrap Iron, free from burnt, for Sale. What offers? —H. J. GASSON & SONS, Government Contractors, Rye. 'Phone, Rye 34.

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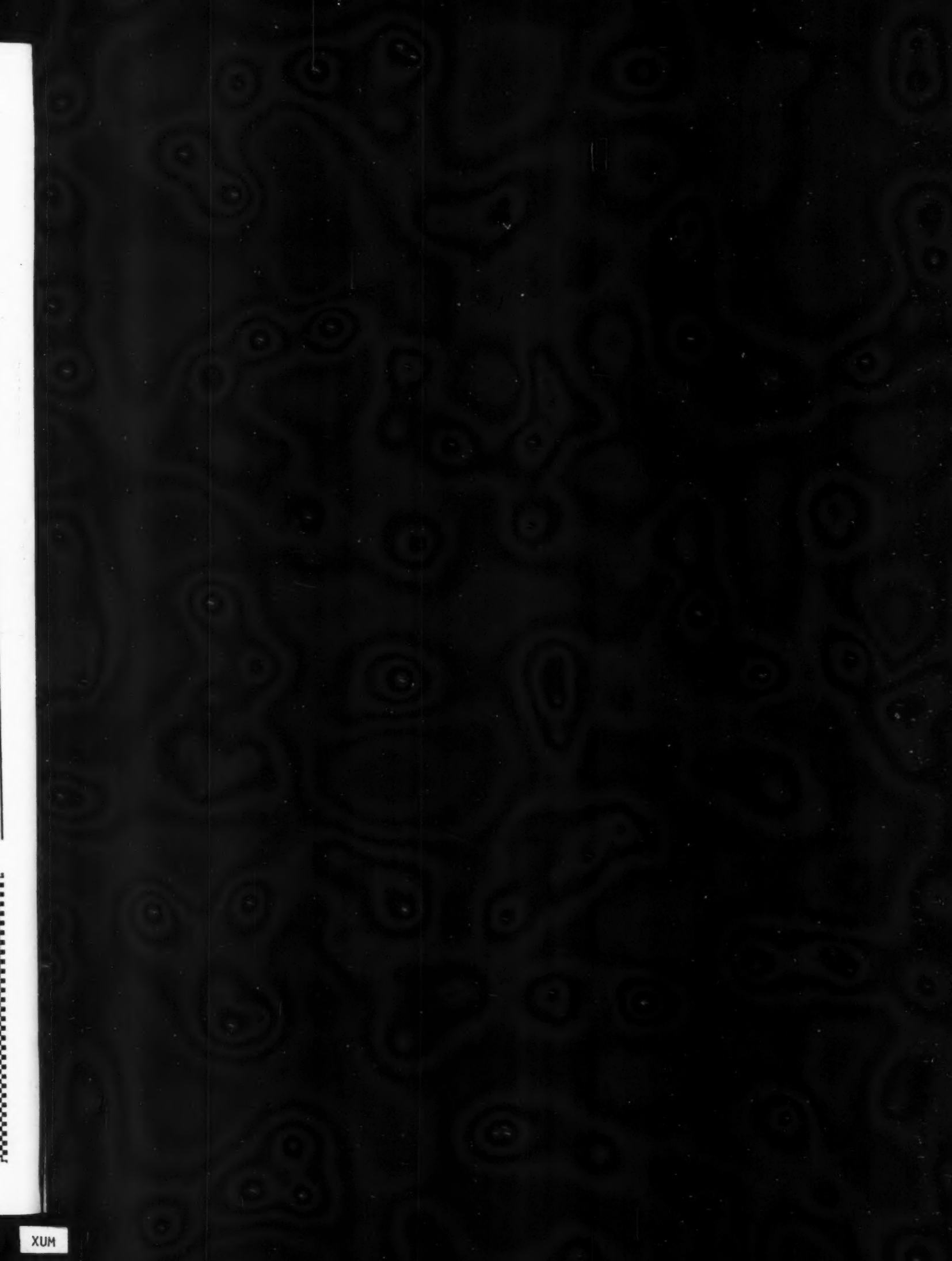

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